FLAP/SLAT
TROUBLESHOOTING GUIDE

TriStar L-1011

P.S.C. 81-01357

LOCKHEED-CALIFORNIA COMPANY

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FLAP AND SLAT SYSTEMS TROUBLESHOOTING GUIDE

CAUTION

THIS DOCUMENT SHOULD BE USED AS A GUIDE ONLY. WHILE THE INFORMATION CONTAINED HEREIN WAS CORRECT AT THE TIME OF WRITING, IT MAY NOT ALWAYS REPRESENT ACTUAL CONFIGURATION AT ANY POINT IN TIME THEREAFTER. IF A DISAGREEMENT OCCURS BETWEEN THIS GUIDE AND THE MAINTENANCE MANUAL, THE L-1011 MAINTENANCE MANUAL IS THE FINAL AUTHORITY.

PREPARED BY
COMMERCIAL CUSTOMER TRAINING AND
MAINTAINABILITY DEPARTMENTS

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SECTION 1.0

INTRODUCTION

This troubleshooting guide is prepared for airline fault isolation of problems related to the L-1011 flap and slat mechanical actuation and asymmetry systems. It is designed to assist by providing information based on current or former problems with these systems.

Section 3.0 of this guide is prepared for "easy" identification of problems related to the flap or slat system. It can be used in analyzing log book reports or verbal pilot reports to help separate problems associated with the mechanical actuation system from problems associated with the asymmetry system.

After the problem has been correctly identified, section 4.0 will assist in troubleshooting by offering practical procedures for solving problems related to the flap or slat asymmetry system. Some asymmetry problems can be intermittent or troublesome to fix, and section 4.0 will help to solve and correct these types of problems as quickly as possible.

Section 5.0 is designed to maintenance fault isolation of problems that can cause a FLAP or SLAT LOCK light. As in other sections, procedures are provided for terminal or overnight troubleshooting.

Problems caused by the flap or slat mechanical actuation system are covered in section 6.0. This section covers mechanical jams that can be caused by friction, lack of lubrication, or a component mechanical failure.

If a disagreement occurs between this guide and the maintenance manual, the L-1011 maintenance manual is the final authority.

SECTION 2.0

BRIEF SYSTEM DESCRIPTION

2.1 FLAP MECHANICAL ACTUATION SYSTEM

The trailing edge flap system (fig. 1) includes four double-slotted Fowler flaps and vanes on each wing. The flaps and vanes are installed aft of the rear spar and auxiliary beam, between the trailing edge structures commonly known as torque boxes. The torque boxes incorporate tracks on which roller carriages operate to support and guide the flaps and vanes.

Each vane is operated by two actuators that slave the vane to the flap. Each flap is actuated by two ballscrew-type actuators mounted to the torque boxes. All actuators are driven by a common torque shaft system mounted on the wing rear spar and auxiliary beam structures. The torque shaft system is operated by a power drive unit (PDU) located in the hydraulic service center. The PDU incorporates two integrally mounted hydraulic motors, one pressurized by hydraulic system A and the other by hydraulic system C. The flap actuation system will operate with or without electrical power and will operate on a single hydraulic system.

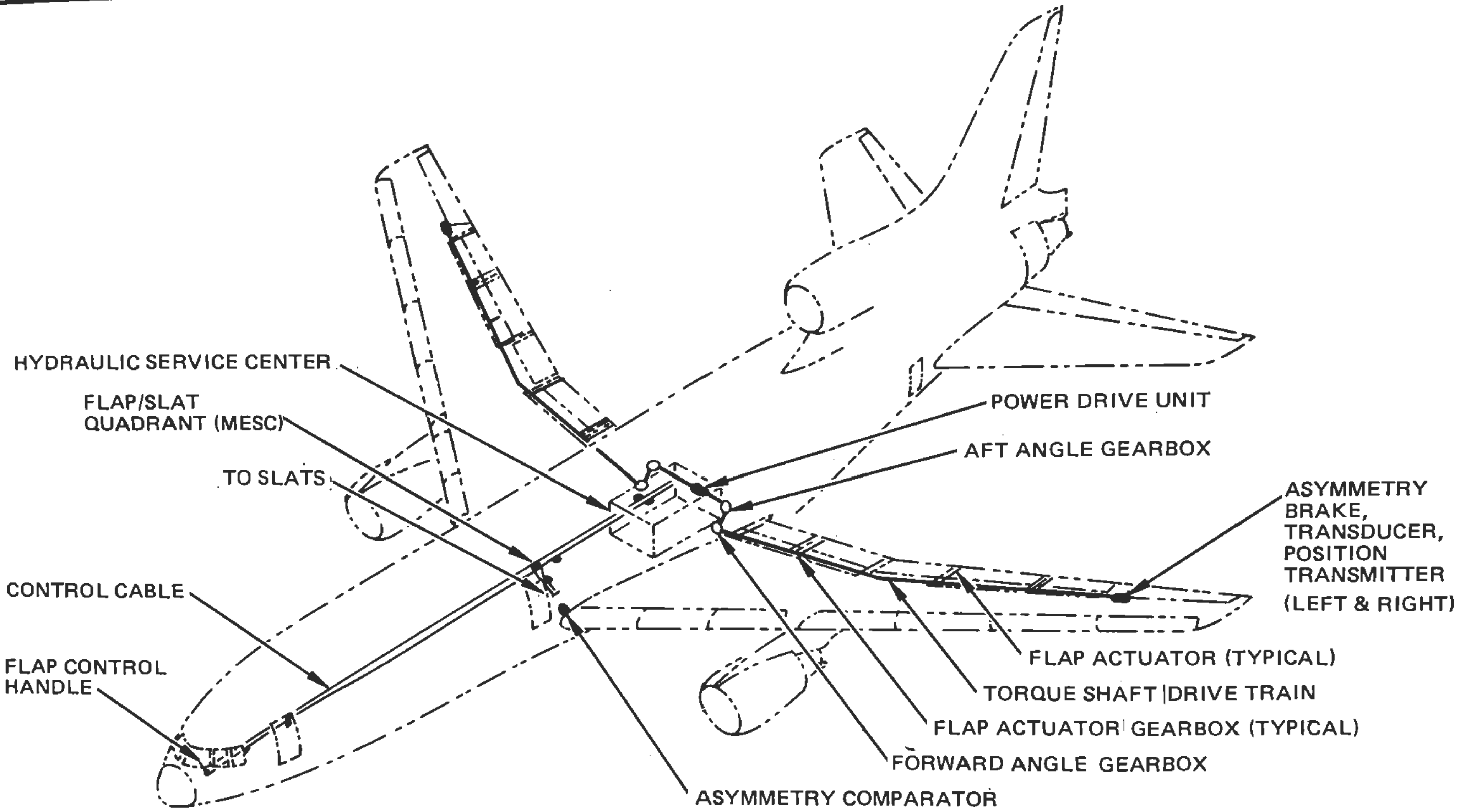


Figure 1. Locations of Flap System Components.

2.2 SLAT MECHANICAL ACTUATION SYSTEM

The leading edge slat system (fig. 2) includes seven slats on each wing. Three slats (Nos. 1, 2, and 3) are inboard of the engine pylon, and four slats (Nos. 4, 5, 6, and 7) are outboard of the pylon. Each slat panel is supported by two radial tracks roller mounted to the wing structure and is operated by a single jackscrew-type actuator. All actuators are driven through a common torque tube drive train by a PDU located in the left wing root. The PDU incorporates two hydraulic motors, one pressurized by hydraulic system A and the other by hydraulic system C. If a single hydraulic system fails, the remaining system and motor are capable of extending the slats against reduced loads. The inboard slats extend 28°, and the outboard slats extend 30°. Operation of the leading edge slat system is controlled by the flap control handle in the flight station. The slat actuation system will operate with or without electrical power.

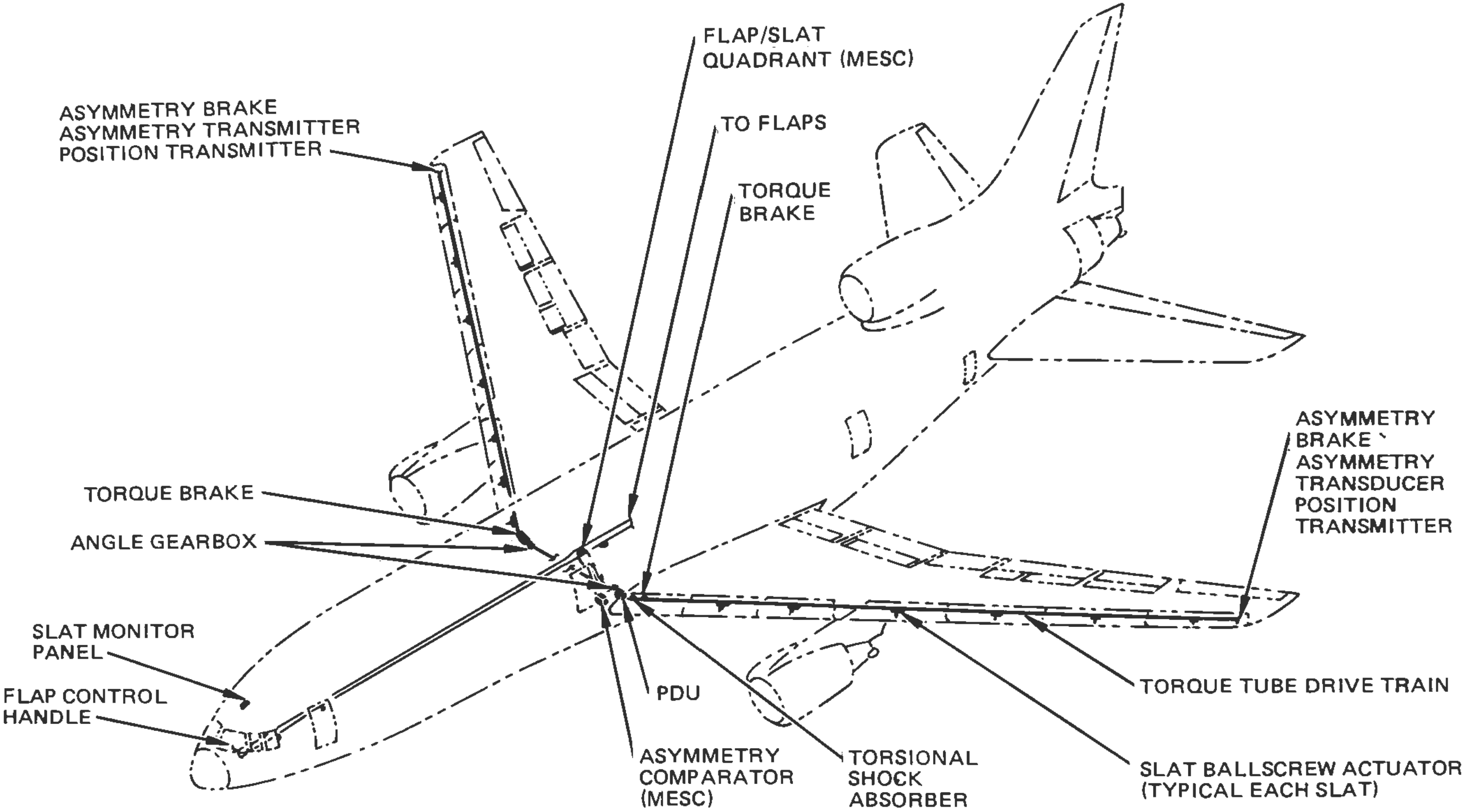


Figure 2. Locations of Slat System Components.

2.3 FLAP AND SLAT ASYMMETRY SYSTEMS

There are two separate asymmetry systems. The asymmetry control systems are provided to shut down and lock the flap or slat system when a significant asymmetrical condition develops. Each system includes an asymmetry brake and an asymmetry transducer in each wing at the outboard end of the torque shaft drive system (figs. 3 and 4) and an asymmetry comparator in the mid electrical service center. The systems limit asymmetry, as sensed by the transducers, to approximately 7° maximum. The flap and slat asymmetry comparators are identical. Both comparators are installed in the mid electrical service centers as shown by figure 5. The asymmetry comparator uses signals from the asymmetry transducers which are driven by the torque shaft drive train in each wing.

Three separate detector channels are provided. Each detector channel of the comparator generates a running comparison of switch actuations in the transducers. When one transducer has produced several switch actuations more than the other, an asymmetry signal is supplied to the voter driver. If the voter driver senses asymmetry in two of the three detector channels, it initiates signals to energize the asymmetry brake solenoids and the PDU solenoid shutoff valves. The signal to the asymmetry brakes is maintained for 2 seconds; the signal to the PDU solenoid valves is continuous. At the same time, a signal is supplied to the lock light driver, which illuminates the appropriate LOCK light on the flight engineer/second officer's (FE/SO's) annunciator panel (fig. 6).

The asymmetry comparator contains monitor circuits designed to compare signals between channels in the various sections of the asymmetry system. The monitor circuits illuminate the ASYM DET FAULT light on the FE/SO's annunciator panel if a problem exists in any one or more of the following components of the asymmetry system: (1) right or left wing asymmetry brake solenoids, (2) flap or slat hydraulic system A and C shutoff valves, (3) external or internal asymmetry comparator power supplies or input power, (4) internal comparator, (5) asymmetry transducers, and (6) the associated wiring.

Schematic diagrams for the flap and slat asymmetry systems are included in appendix 1.

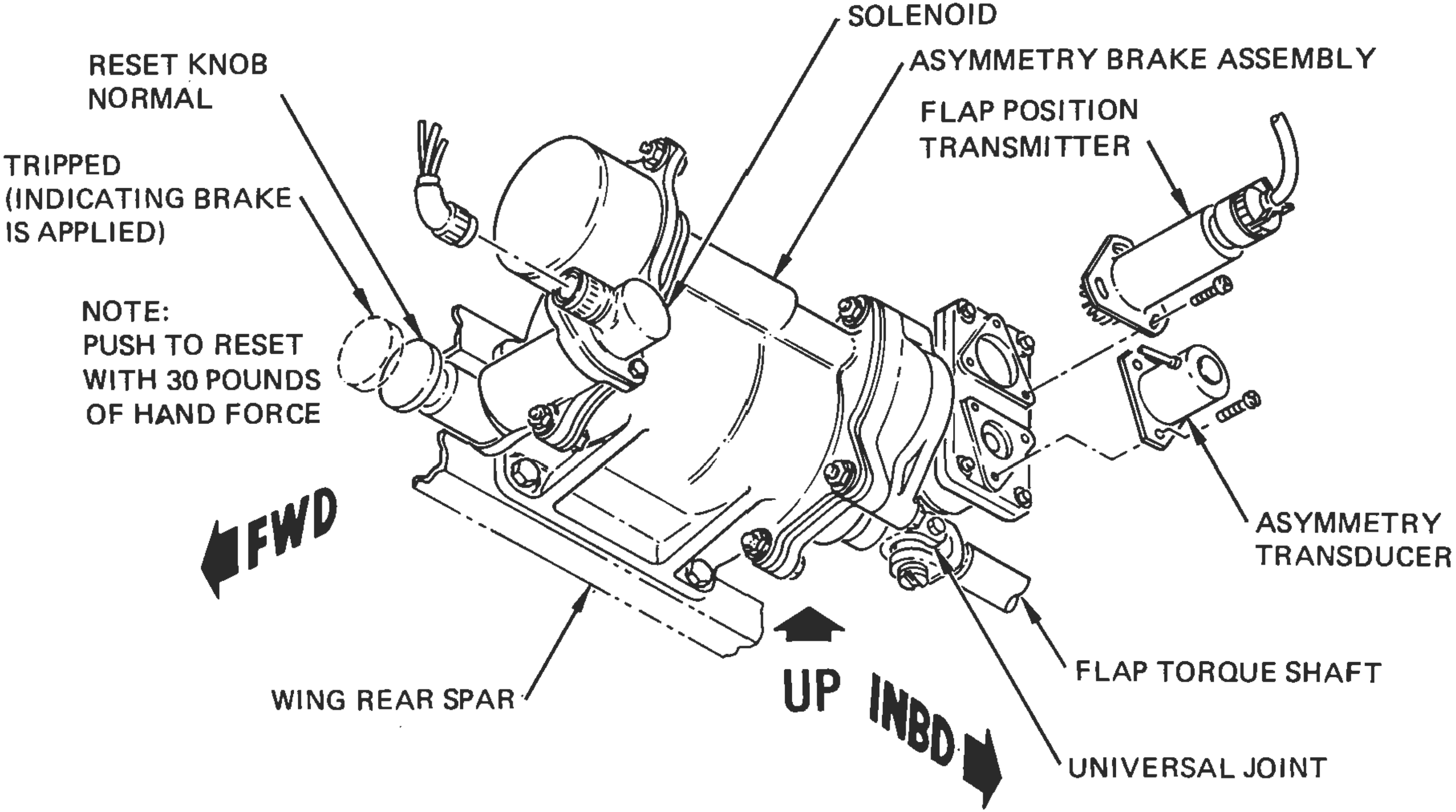


Figure 3. Flap Asymmetry Brake.

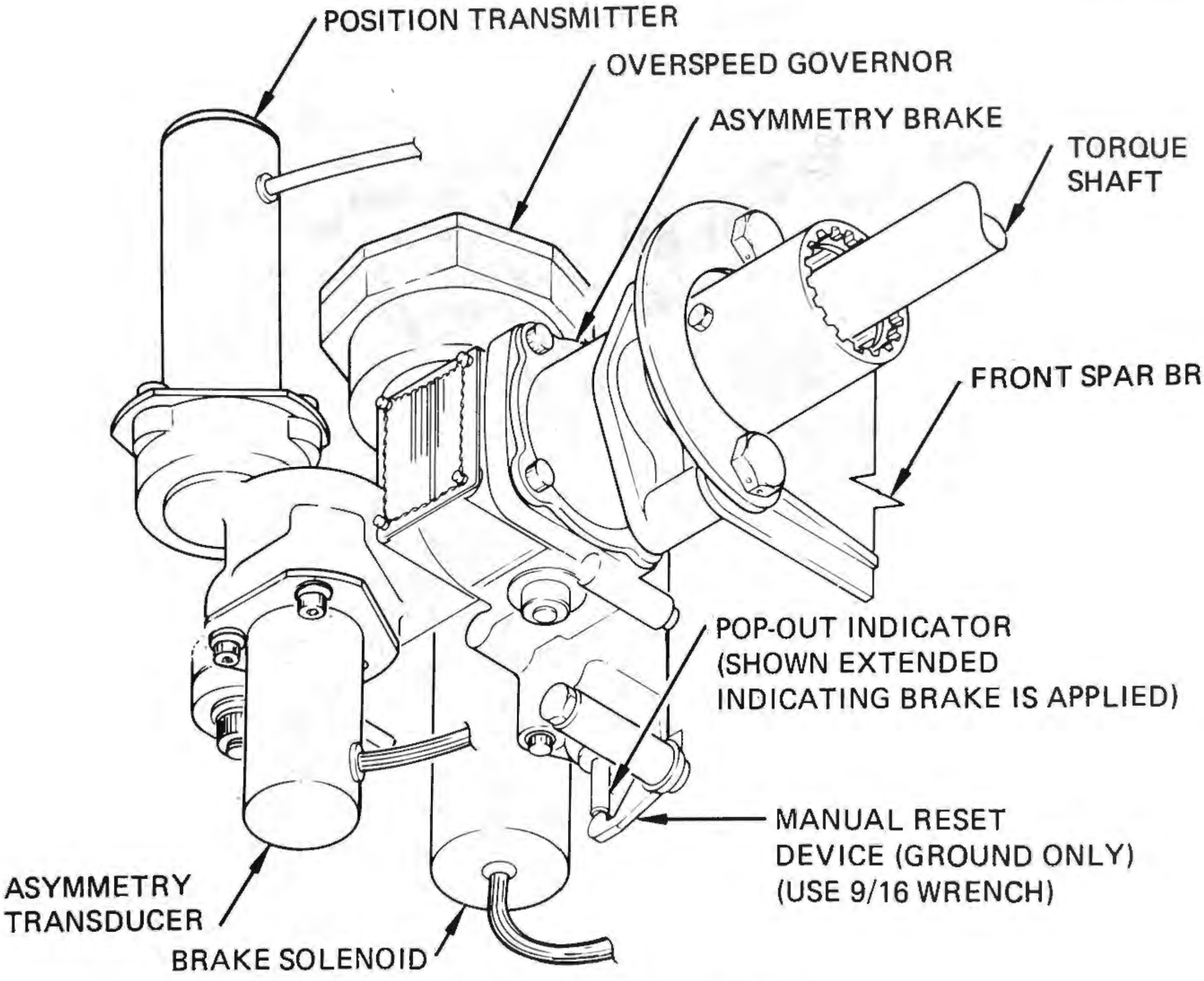


Figure 4. Slat Asymmetry Brake.

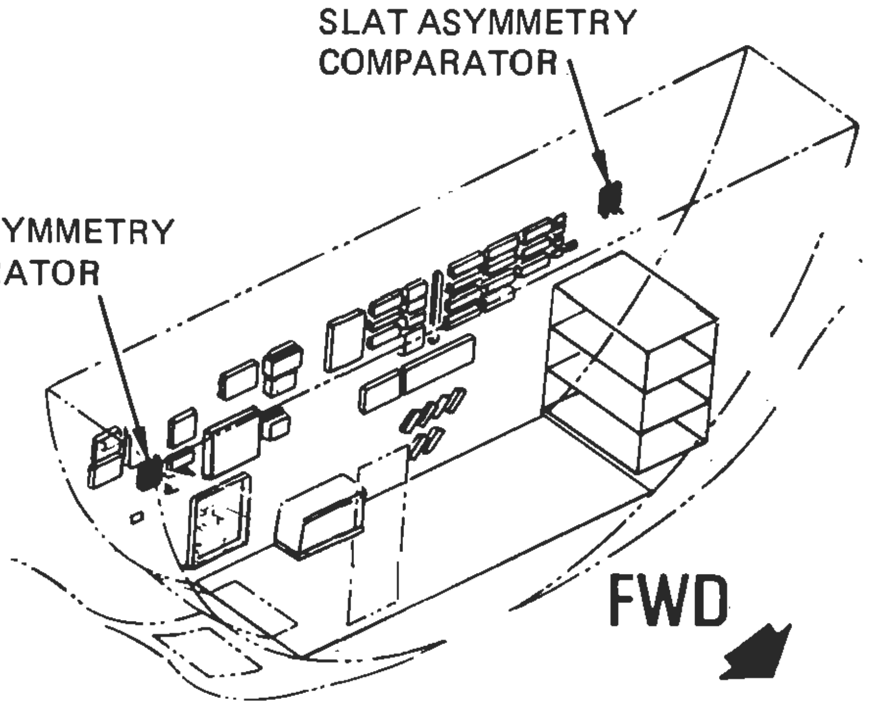


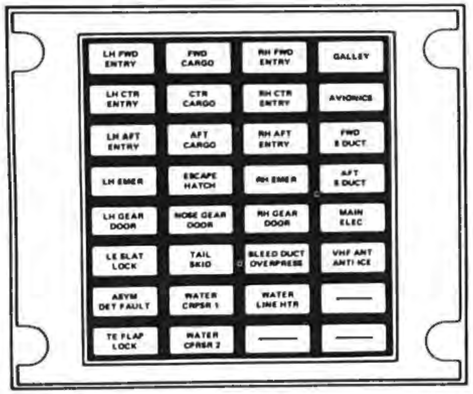
Figure 5. Mid Electrical Service Center.

NOTE: SB 093-27-214 provides a change in indication for FLAP/SLAT LOCK and ASYM DET FAULT lights such that faults are isolated to the flap or slat asymmetry system. The two indicator lamp configurations are shown in figure 6. If the FLAP/SLAT LOCK light is on, the affected system can be determined by:

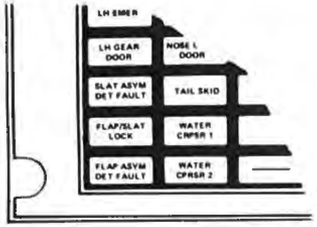
1. observing which system does not operate, or
2. observing the position of the brake indicator on the flap or slat asymmetry brake (wingtips).

APPLICABLE TO AIRCRAFT LOCKHEED
SERIAL NO. 193A, B, C, E, M, P, R, S, K, L,
1002 THROUGH 1250

BEFORE
MODIFICATION

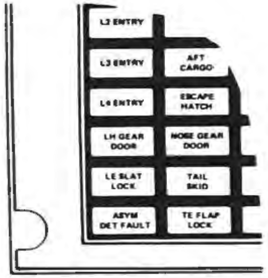


AFTER
MODIFICATION



APPLICABLE TO AIRCRAFT LOCKHEED
SERIAL NO. 193N, T, U, V, W, G. Y, J,
1083 THROUGH 1250

BEFORE MODIFICATION
MODIFICATION



AFTER
MODIFICATION

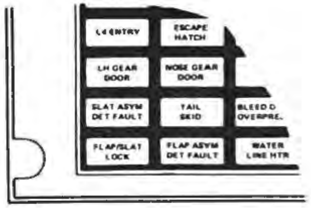


Figure 6. Indicator Lamp Configurations on Flight Engineer's Annunciator Panel Assembly.

SECTION 3.0

INITIAL PROBLEM IDENTIFICATION

Use the following questions, the pilots' log book or verbal report, and ground operation of the flap or slat system to identify and separate problems to the proper system. Figure 7 shows the FE/SO's station and the location of the ASYM DET FAULT lights.

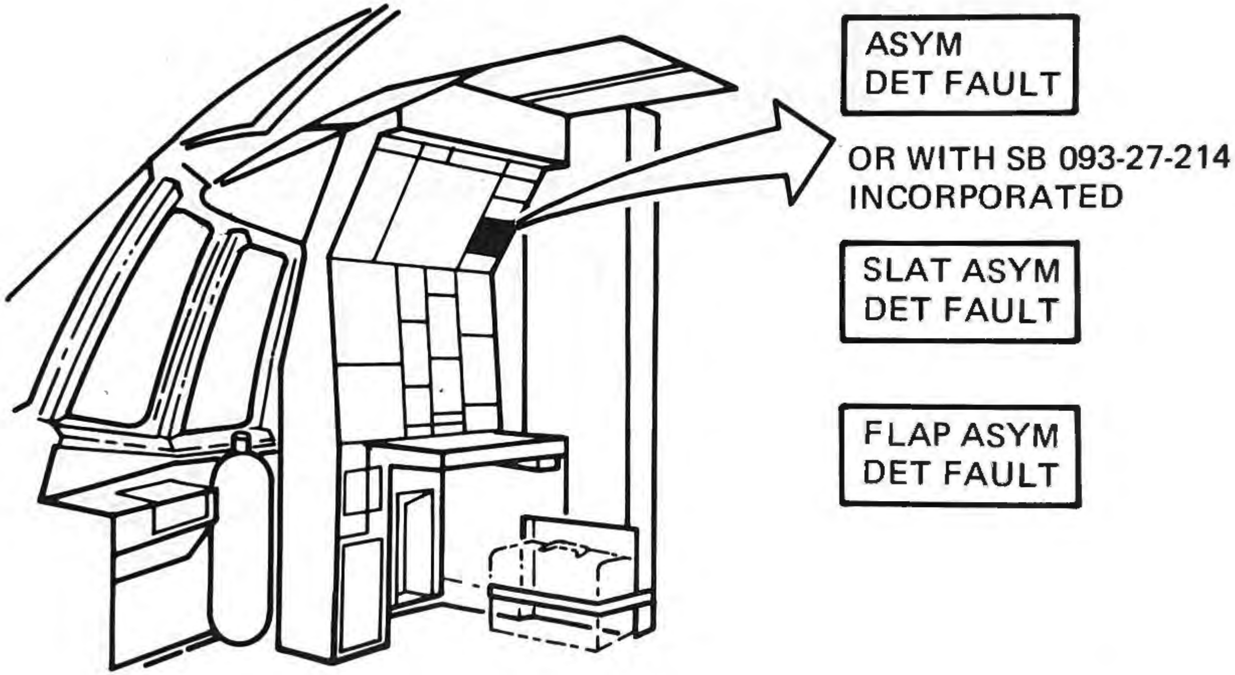
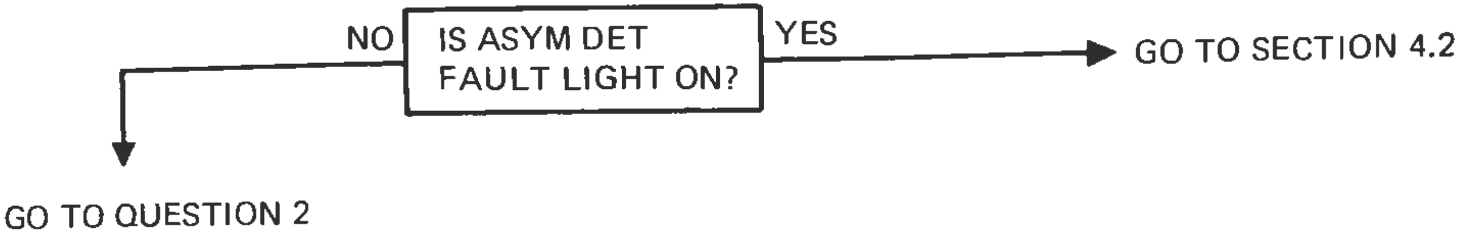


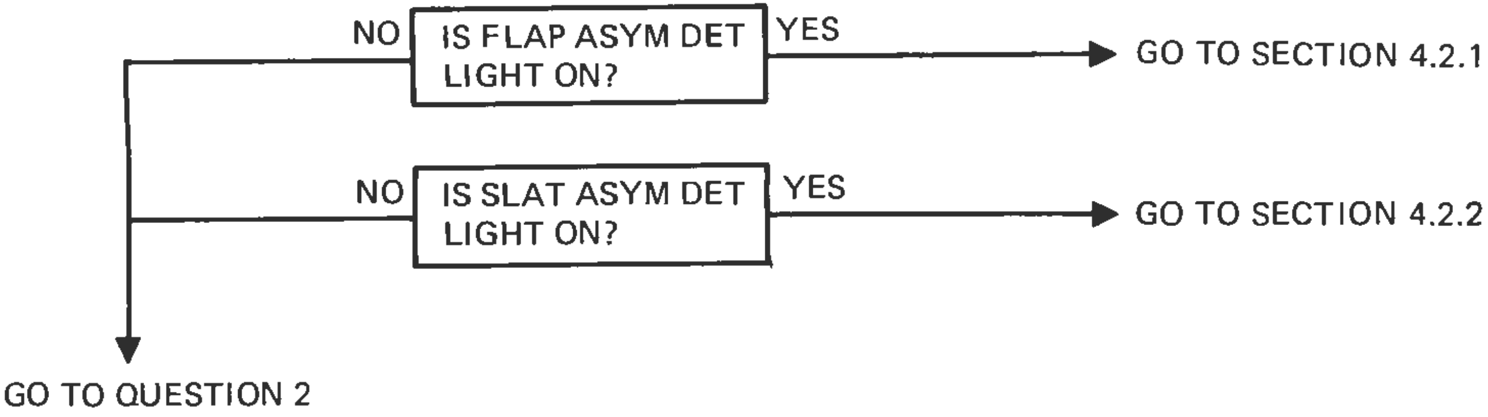
Figure 7. FE/SO's Station and ASYM DET FAULT Lights.

Question 1: Is the ASYM DET FAULT light on the FE/SO's annunciator panel illuminated?

SB 093-27-214 NOT INCORPORATED

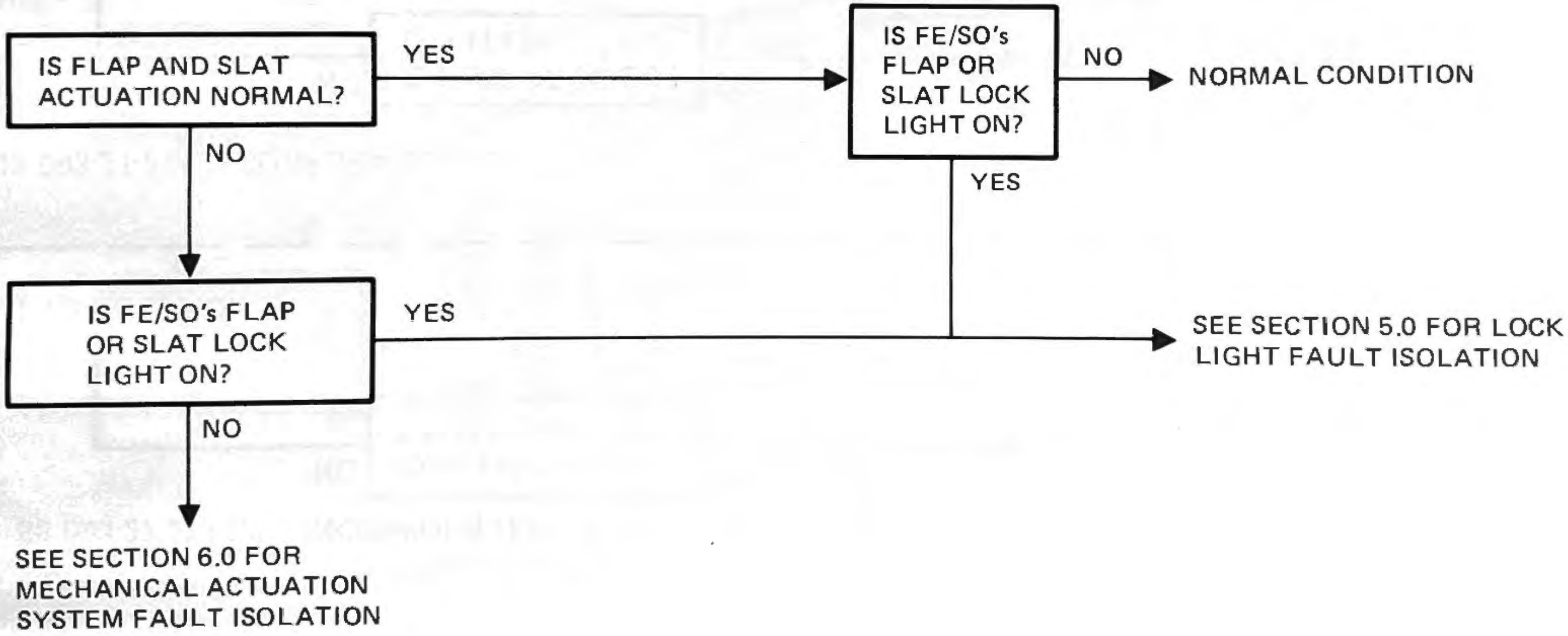


SB 093-27-214 INCORPORATED



Question 2: Do the flap and slat systems operate normally from the fully retracted position to the fully extended position as indicated by pilot report or during troubleshooting procedures?

NOTE: Do not use AC electrical pumps to check the flap or slat system, because these pumps can trip an asymmetry brake.


IS FLAP AND SLAT ACTUATION NORMAL?
YES
IS FE/SO's FLAP OR SLAT LOCK LIGHT ON?
NO
NORMAL CONDITION
YES
NO
IS FE/SO's FLAP OR SLAT LOCK LIGHT ON?
YES
SEE SECTION 5.0 FOR LOCK LIGHT FAULT ISOLATION
NO
SEE SECTION 6.0 FOR MECHANICAL ACTUATION SYSTEM FAULT ISOLATION

SECTION 4.0

ASYMMETRY SYSTEM PROBLEMS

4.1 ASYMMETRY COMPARATOR FAULT ISOLATION PROCEDURES

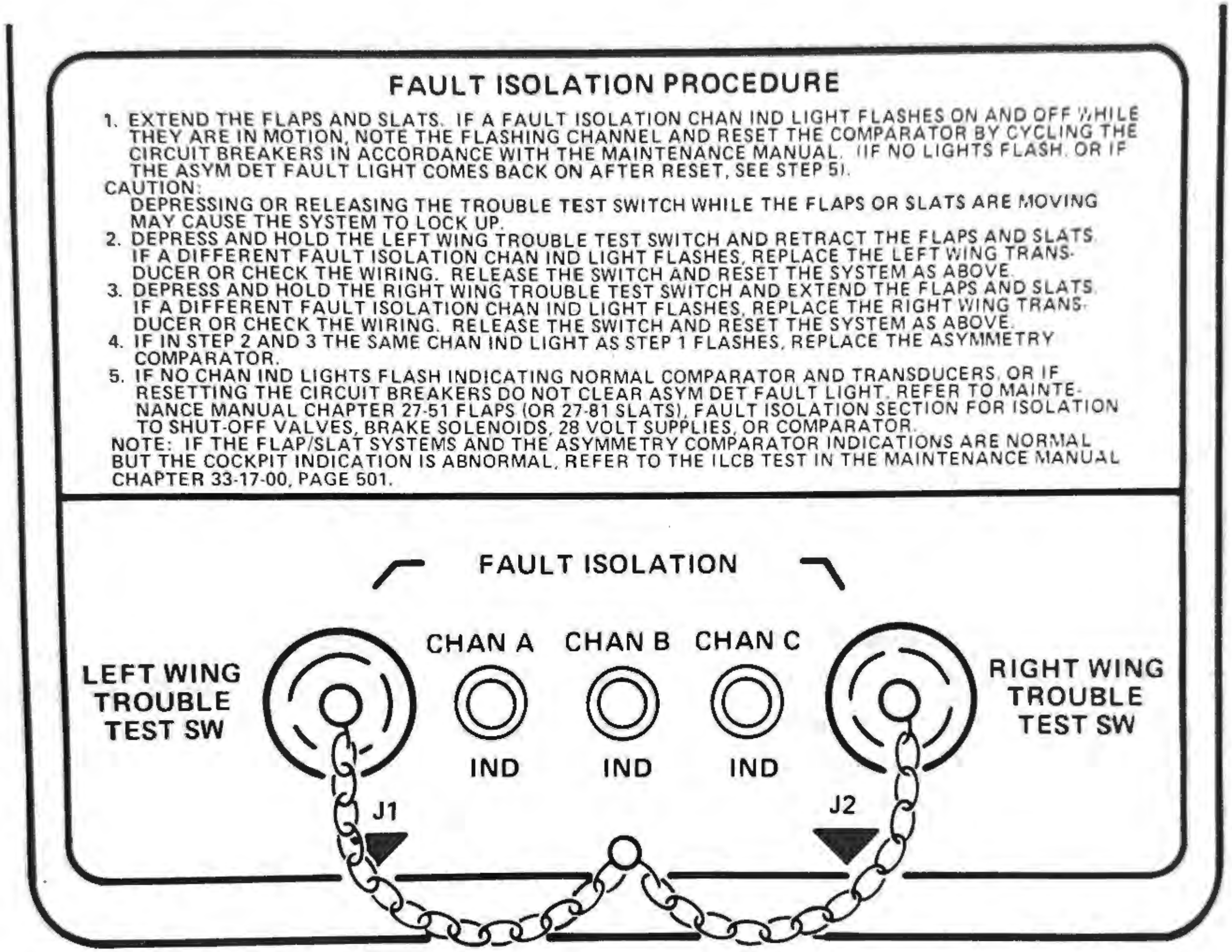
The front panel placard and test switches for the asymmetry comparator are shown in figure 8. Fault isolation procedures are described below.

Caution: During fault isolation test, releasing or depressing either test switch while the flaps or slats are moving may cause the associated comparator to lock up the surface. Therefore, do not release/push trouble test switch for any reason when surface is moving.

1. Extend the flaps and slats and note on the comparator whether a fault isolation channel indicator light flashes on and off while the flaps or slats are in motion. Remember the flashing channel and reset the comparator by cycling the associated asymmetry brake circuit breakers. If no lights flash or if the asymmetry detection fault light comes on after reset, go to step 5.

   Do not push or release the trouble test switch for any reason while the surfaces are moving.

2. Depress and hold the left wing trouble test switch, and retract the flaps and slats. If a different fault isolation channel light flashes, replace the left wing transducer or check wiring. Release trouble test switch and reset associated asymmetry brake circuit breakers.



FAULT ISOLATION PROCEDURE

1. EXTEND THE FLAPS AND SLATS. IF A FAULT ISOLATION CHAN IND LIGHT FLASHES ON AND OFF WHILE THEY ARE IN MOTION, NOTE THE FLASHING CHANNEL AND RESET THE COMPARATOR BY CYCLING THE CIRCUIT BREAKERS IN ACCORDANCE WITH THE MAINTENANCE MANUAL. (IF NO LIGHTS FLASH, OR IF THE ASYM DET FAULT LIGHT COMES BACK ON AFTER RESET, SEE STEP 5).

CAUTION:
DEPRESSING OR RELEASING THE TROUBLE TEST SWITCH WHILE THE FLAPS OR SLATS ARE MOVING MAY CAUSE THE SYSTEM TO LOCK UP.

2. DEPRESS AND HOLD THE LEFT WING TROUBLE TEST SWITCH AND RETRACT THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE LEFT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
3. DEPRESS AND HOLD THE RIGHT WING TROUBLE TEST SWITCH AND EXTEND THE FLAPS AND SLATS. IF A DIFFERENT FAULT ISOLATION CHAN IND LIGHT FLASHES, REPLACE THE RIGHT WING TRANSDUCER OR CHECK THE WIRING. RELEASE THE SWITCH AND RESET THE SYSTEM AS ABOVE.
4. IF IN STEP 2 AND 3 THE SAME CHAN IND LIGHT AS STEP 1 FLASHES, REPLACE THE ASYMMETRY COMPARATOR.
5. IF NO CHAN IND LIGHTS FLASH INDICATING NORMAL COMPARATOR AND TRANSDUCERS, OR IF RESETTING THE CIRCUIT BREAKERS DO NOT CLEAR ASYM DET FAULT LIGHT, REFER TO MAINTENANCE MANUAL CHAPTER 27-51 FLAPS (OR 27-81 SLATS), FAULT ISOLATION SECTION FOR ISOLATION TO SHUT-OFF VALVES, BRAKE SOLENOIDS, 28 VOLT SUPPLIES, OR COMPARATOR.

NOTE: IF THE FLAP/SLAT SYSTEMS AND THE ASYMMETRY COMPARATOR INDICATIONS ARE NORMAL BUT THE COCKPIT INDICATION IS ABNORMAL, REFER TO THE ILCB TEST IN THE MAINTENANCE MANUAL CHAPTER 33-17-00, PAGE 501.

Figure 8. Asymmetry Comparator – Front Panel Placard and Test Switches.

For wiring checks, see figure 9 (flaps) or figure 12 (slats).

3. Depress and hold the right wing trouble test switch, and extend the flaps and slats. If a different fault isolation channel indicator light flashes, replace the right wing transducer or check wiring. Release the trouble test switch and reset associated asymmetry brake circuit breakers.

   For wiring checks, see figure 9 (flaps) or figure 12 (slats).

4. If in steps 2 and 3 the same channel indicator light as in step 1 flashes or exhibits steady illumination, replace the asymmetry comparator.

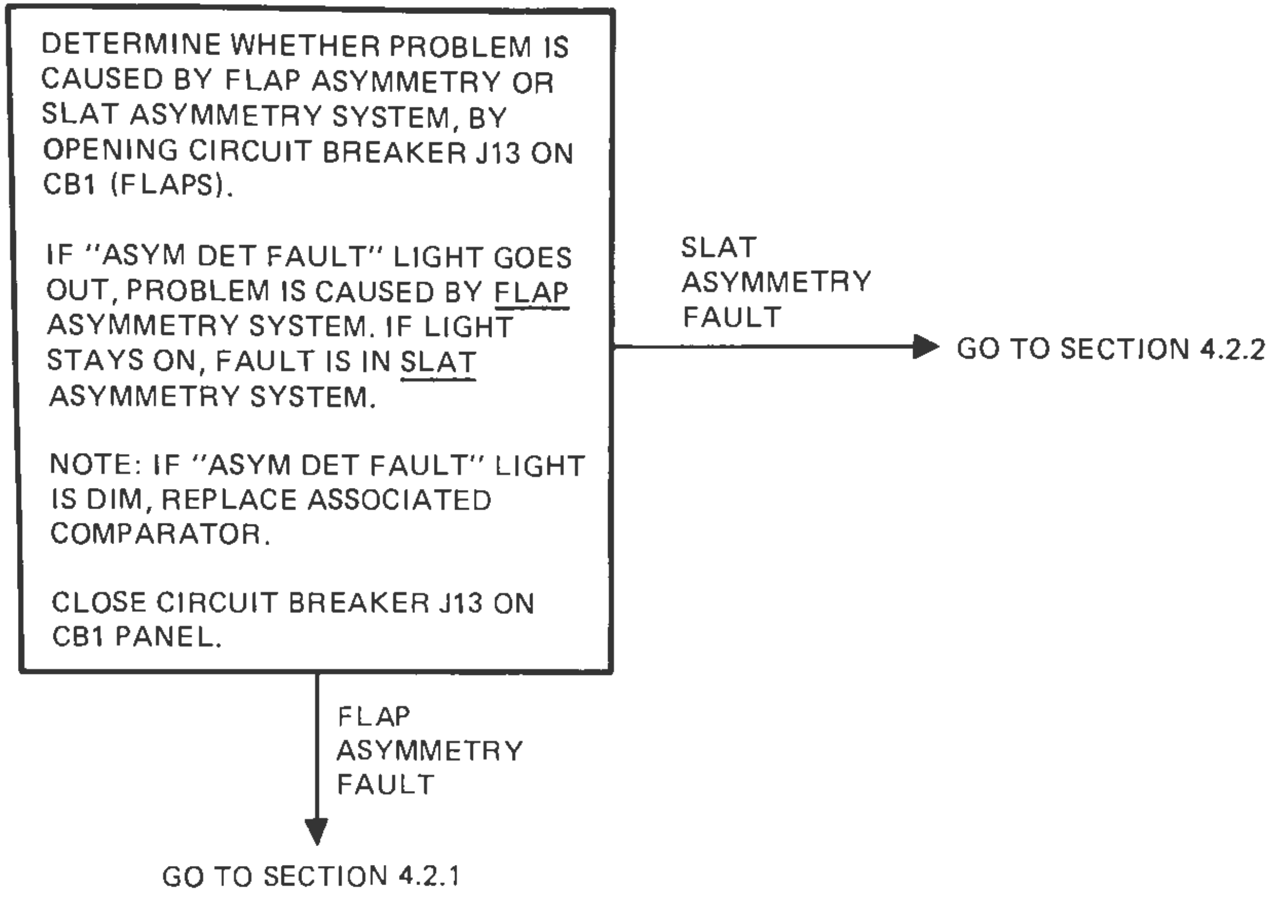
5. If no channel indicator lights flash, indicating normal comparator and transducers, or if resetting the circuit breakers does not turn off the asymmetry detection fault light, refer to Maintenance Manual 27-51-XX (flaps) or 27-81-XX (slats) for isolation to shutoff valves, asymmetry brake solenoids, 28-volt supplies, or comparator.

   For wiring checks, see section 4.2.1, condition 1 (flaps) or section 4.2.2, condition 1 (slats).

Note: If the flap/slat systems and asymmetry comparator indications are normal, but flight station indication is abnormal, refer to the ILCB test in the Maintenance Manual, Chapter 33-17-00, page 501.

4.2 FAULT IDENTIFICATION

The ASYM DET FAULT light on the flight engineer's panel is illuminated whenever a first failure condition is detected by either the flap or slat asymmetry comparators. Use the following block diagram to identify faults to either the flap or slat asymmetry system.



DETERMINE WHETHER PROBLEM IS CAUSED BY FLAP ASYMMETRY OR SLAT ASYMMETRY SYSTEM, BY OPENING CIRCUIT BREAKER J13 ON CB1 (FLAPS).

IF "ASYM DET FAULT" LIGHT GOES OUT, PROBLEM IS CAUSED BY FLAP ASYMMETRY SYSTEM. IF LIGHT STAYS ON, FAULT IS IN SLAT ASYMMETRY SYSTEM.

NOTE: IF "ASYM DET FAULT" LIGHT IS DIM, REPLACE ASSOCIATED COMPARATOR.

CLOSE CIRCUIT BREAKER J13 ON CB1 PANEL.

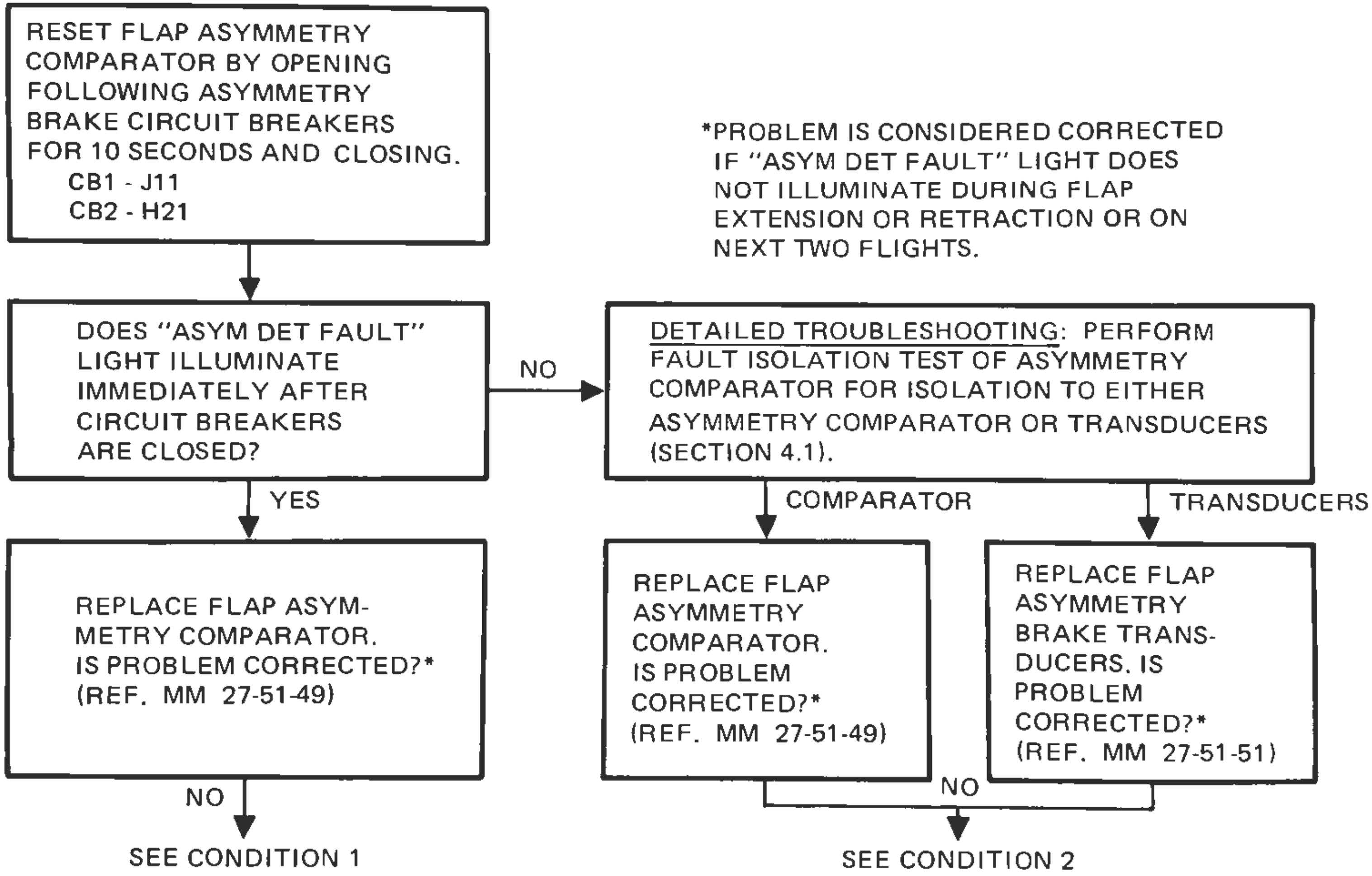
GO TO SECTION 4.2.2

GO TO SECTION 4.2.1

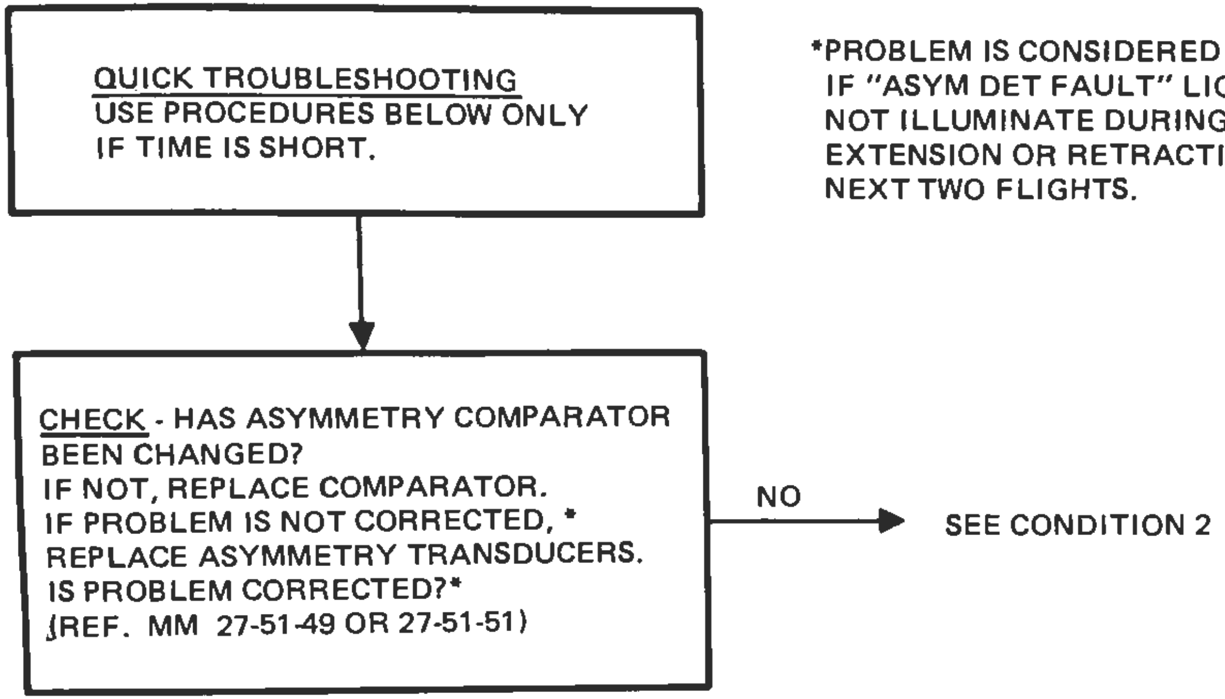
4.2.1 Flap Faults

The following block diagrams outline troubleshooting procedures for faults isolated to the flap asymmetry system.

NOTE: Check flap comparator and note channel failure if problem has occurred previously.


RESET FLAP ASYMMETRY COMPARATOR BY OPENING FOLLOWING ASYMMETRY BRAKE CIRCUIT BREAKERS FOR 10 SECONDS AND CLOSING.
CB1 - J11
CB2 - H21
DOES "ASYM DET FAULT" LIGHT ILLUMINATE IMMEDIATELY AFTER CIRCUIT BREAKERS ARE CLOSED?
NO
DETAILED TROUBLESHOOTING: PERFORM FAULT ISOLATION TEST OF ASYMMETRY COMPARATOR FOR ISOLATION TO EITHER ASYMMETRY COMPARATOR OR TRANSDUCERS (SECTION 4.1).
YES
COMPARATOR
TRANSDUCERS
REPLACE FLAP ASYMMETRY COMPARATOR. IS PROBLEM CORRECTED?* (REF. MM 27-51-49)
REPLACE FLAP ASYMMETRY COMPARATOR. IS PROBLEM CORRECTED?* (REF. MM 27-51-49)
REPLACE FLAP ASYMMETRY BRAKE TRANSDUCERS. IS PROBLEM CORRECTED?* (REF. MM 27-51-51)
NO
NO
SEE CONDITION 1
SEE CONDITION 2

*PROBLEM IS CONSIDERED CORRECTED IF "ASYM DET FAULT" LIGHT DOES NOT ILLUMINATE DURING FLAP EXTENSION OR RETRACTION OR ON NEXT TWO FLIGHTS.



QUICK TROUBLESHOOTING
USE PROCEDURES BELOW ONLY
IF TIME IS SHORT.

CHECK - HAS ASYMMETRY COMPARATOR
BEEN CHANGED?
IF NOT, REPLACE COMPARATOR.
IF PROBLEM IS NOT CORRECTED, *
REPLACE ASYMMETRY TRANSDUCERS.
IS PROBLEM CORRECTED?*
(REF. MM 27-51-49 OR 27-51-51)

NO

SEE CONDITION 2

*PROBLEM IS CONSIDERED CORRECTED IF "ASYM DET FAULT" LIGHT DOES NOT ILLUMINATE DURING FLAP EXTENSION OR RETRACTION OR ON NEXT TWO FLIGHTS.

Condition 1: The ASYM DET FAULT light is on, and the problem has been isolated to the flap asymmetry system. The light comes on immediately after circuit breaker reset.

This problem is typical of problems caused by either the flap asymmetry brake (or associated wiring), the flap power drive unit (PDU) solenoids (or associated wiring), or the 28-volt power supply inputs. To isolate the problem, perform multimeter circuit checks in accordance with table 1. Troubleshoot asymmetry system circuits that do not agree with established voltage or resistance levels. Refer to L-1011 wiring diagram 27-51-01 for exact wiring and routing details. Perform circuit checks at flap asymmetry comparator connectors.

TABLE 1. TRAILING-EDGE FLAP ASYMMETRY COMPARATOR CIRCUITRY

(a) VOLTAGE CHECKS. ALL VOLTAGES ARE TO GROUND.

PLUG	PIN	COMPONENT/CIRCUIT	VOLTAGE	EQUIP. NO.	MAINT. MAN. REF.
2781-P9	15	CIRCUIT BREAKER, CB1-J11	28 VDC	2700-CB2	–
	3	PDU, NO. 2 SWITCHBOX-LH	28 VDC OR 0 VDC [1]	2751-HP1A3	27-51-12
	4	PDU, NO. 2 SWITCHBOX-LH	28 VDC OR 0 VDC [1]	2751-HP1A3	27-51-12
2781-P13	15	CIRCUIT BREAKER, CB2-H21	28 VDC	2700-CB3	–
	3	PDU, NO. 1 SWITCHBOX-RH	28 VDC OR 0 VDC [1]	2751-HP1A4	27-51-12
	4	PDU, NO. 1 SWITCHBOX-RH	28 VDC OR 0 VDC [1]	2751-HP1A4	27-51-12

[1] READINGS SHOULD BE IDENTICAL: 28 VDC WITH FLAP HANDLE UP AND FLAP PDU IN THE FLAP-UP POSITION; OTHERWISE, 0 VDC.

(b) RESISTANCE CHECKS. ALL RESISTANCES ARE TO GROUND.

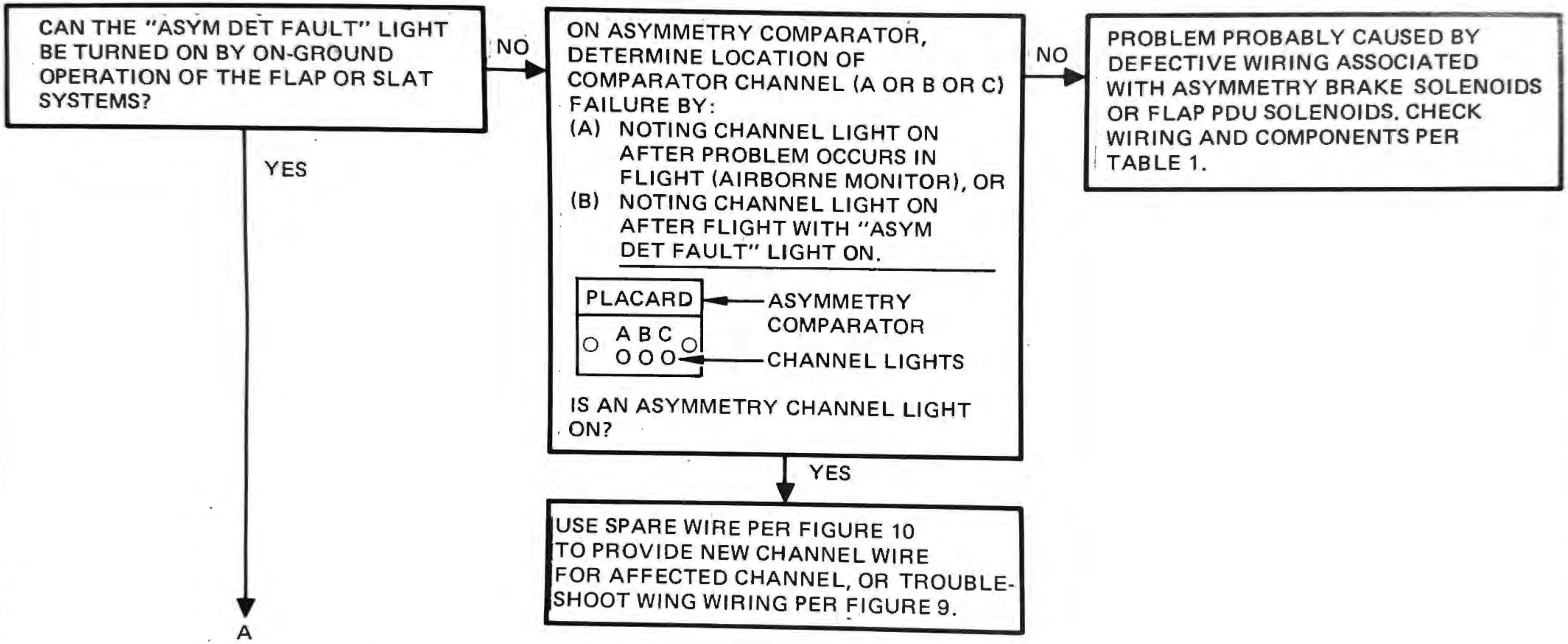
NOTE: OPEN CIRCUIT BREAKERS CB1-J11 AND CB2-H21 BEFORE TAKING NEXT CIRCUIT READINGS.

PLUG	PIN	COMPONENT/CIRCUIT	RESISTANCE	EQUIP. NO.	MAINT. MAN. REF.
2781-P9	3	PDU, SHUTOFF VALVE SOLENOID NO. 1	100Ω	2751-HP1A1	27-51-10
	4	PDU, SHUTOFF VALVE SOLENOID NO. 1	100Ω	2751-HP1A1	27-51-10
	23	LH FLAP ASYM. BRAKE SOLENOID	20Ω	2751-A3	27-51-50
	27	LH FLAP ASYM. BRAKE SOLENOID	20Ω	2751-A3	27-51-50
2781-P13	3	PDU, SHUTOFF VALVE SOLENOID NO. 2	100Ω	2751-HP1A2	27-51-10
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2	100Ω	2751-HP1A2	27-51-10
	23	RH FLAP ASYM. BRAKE SOLENOID	20Ω	2751-A2	27-51-50
	27	RH FLAP ASYM. BRAKE SOLENOID	20Ω	2751-A2	27-51-50

NOTE: REFER TO WIRING DIAGRAM 27-51-01 FOR DETAILED TROUBLESHOOTING OF INDIVIDUAL WIRES.

Condition 2: The ASYM DET FAULT light is on, and the problem has been isolated to the flap asymmetry system. The light stays off after circuit breaker reset.

The problem indicated by this condition may be difficult to isolate and correct. This section provides troubleshooting procedures for problems that are intermittent or difficult to isolate due to wiring problems.


CAN THE "ASYM DET FAULT" LIGHT BE TURNED ON BY ON-GROUND OPERATION OF THE FLAP OR SLAT SYSTEMS?

ON ASYMMETRY COMPARATOR, DETERMINE LOCATION OF COMPARATOR CHANNEL (A OR B OR C) FAILURE BY:

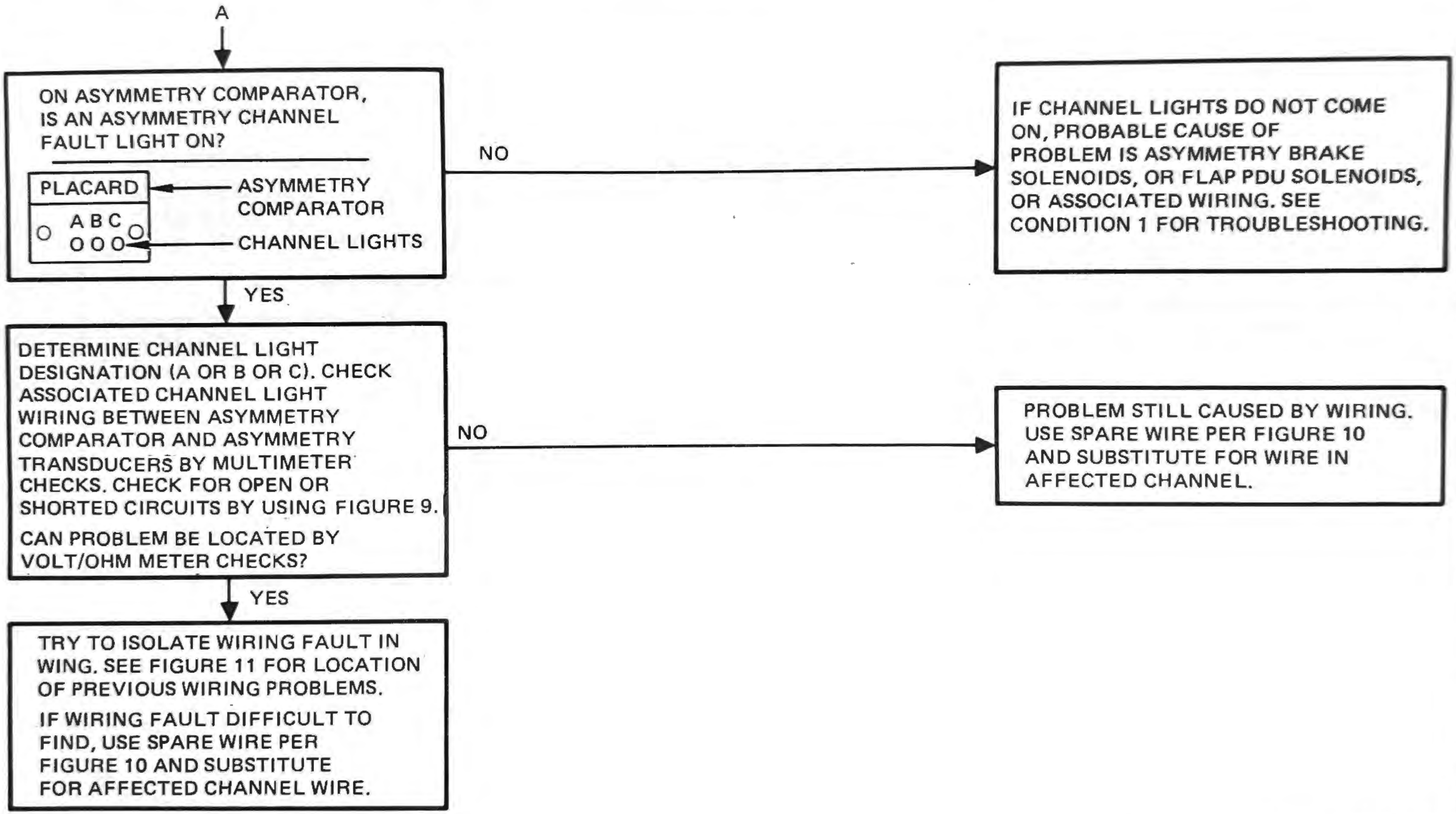
(A) NOTING CHANNEL LIGHT ON AFTER PROBLEM OCCURS IN FLIGHT (AIRBORNE MONITOR), OR

(B) NOTING CHANNEL LIGHT ON AFTER FLIGHT WITH "ASYM DET FAULT" LIGHT ON.

IS AN ASYMMETRY CHANNEL LIGHT ON?

PROBLEM PROBABLY CAUSED BY DEFECTIVE WIRING ASSOCIATED WITH ASYMMETRY BRAKE SOLENOIDS OR FLAP PDU SOLENOIDS. CHECK WIRING AND COMPONENTS PER TABLE 1.

USE SPARE WIRE PER FIGURE 10 TO PROVIDE NEW CHANNEL WIRE FOR AFFECTED CHANNEL, OR TROUBLESHOOT WING WIRING PER FIGURE 9.



ON ASYMMETRY COMPARATOR, IS AN ASYMMETRY CHANNEL FAULT LIGHT ON?

IF CHANNEL LIGHTS DO NOT COME ON, PROBABLE CAUSE OF PROBLEM IS ASYMMETRY BRAKE SOLENOIDS, OR FLAP PDU SOLENOIDS, OR ASSOCIATED WIRING. SEE CONDITION 1 FOR TROUBLESHOOTING.

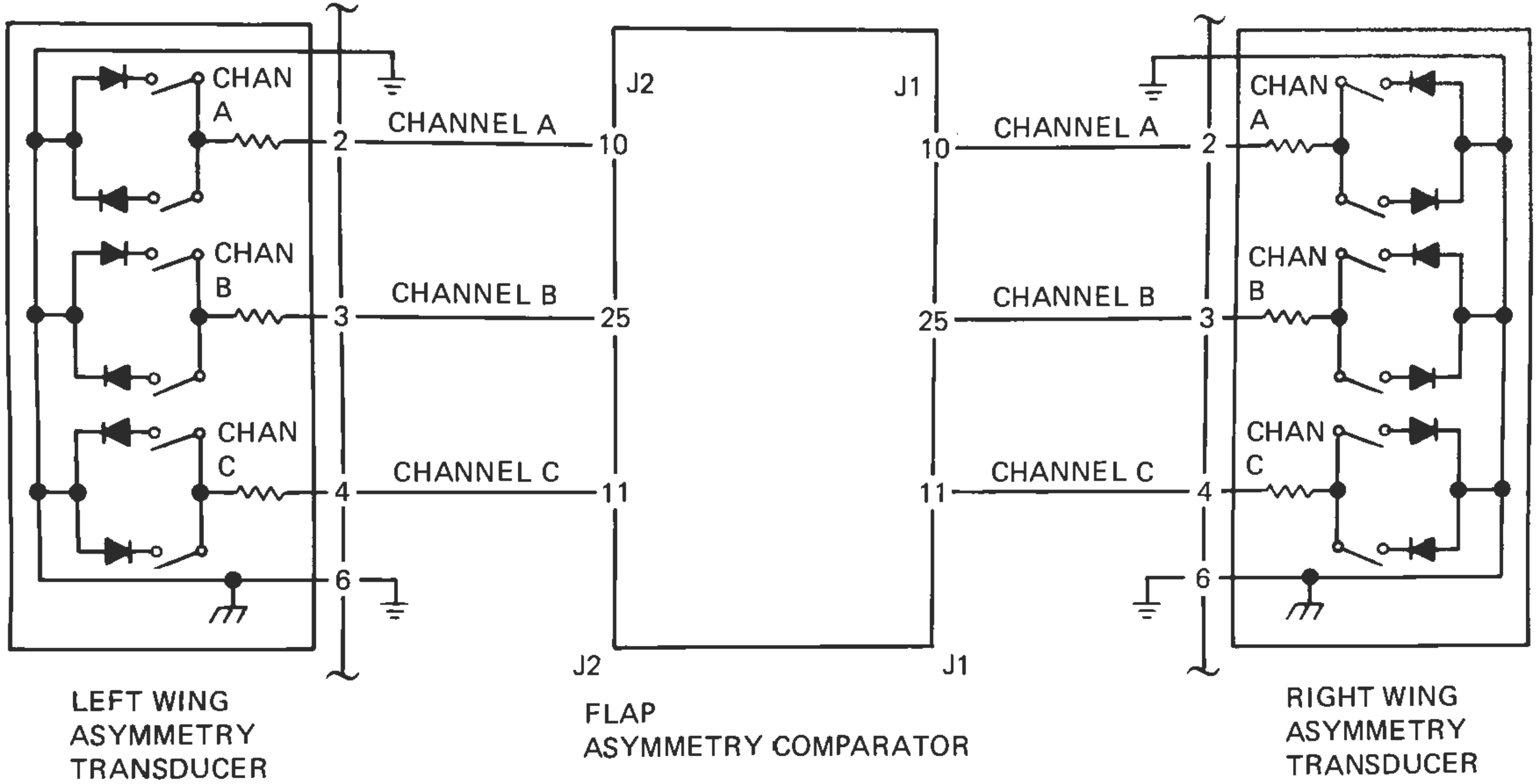
DETERMINE CHANNEL LIGHT DESIGNATION (A OR B OR C). CHECK ASSOCIATED CHANNEL LIGHT WIRING BETWEEN ASYMMETRY COMPARATOR AND ASYMMETRY TRANSDUCERS BY MULTIMETER CHECKS. CHECK FOR OPEN OR SHORTED CIRCUITS BY USING FIGURE 9.

CAN PROBLEM BE LOCATED BY VOLT/OHM METER CHECKS?

PROBLEM STILL CAUSED BY WIRING. USE SPARE WIRE PER FIGURE 10 AND SUBSTITUTE FOR WIRE IN AFFECTED CHANNEL.

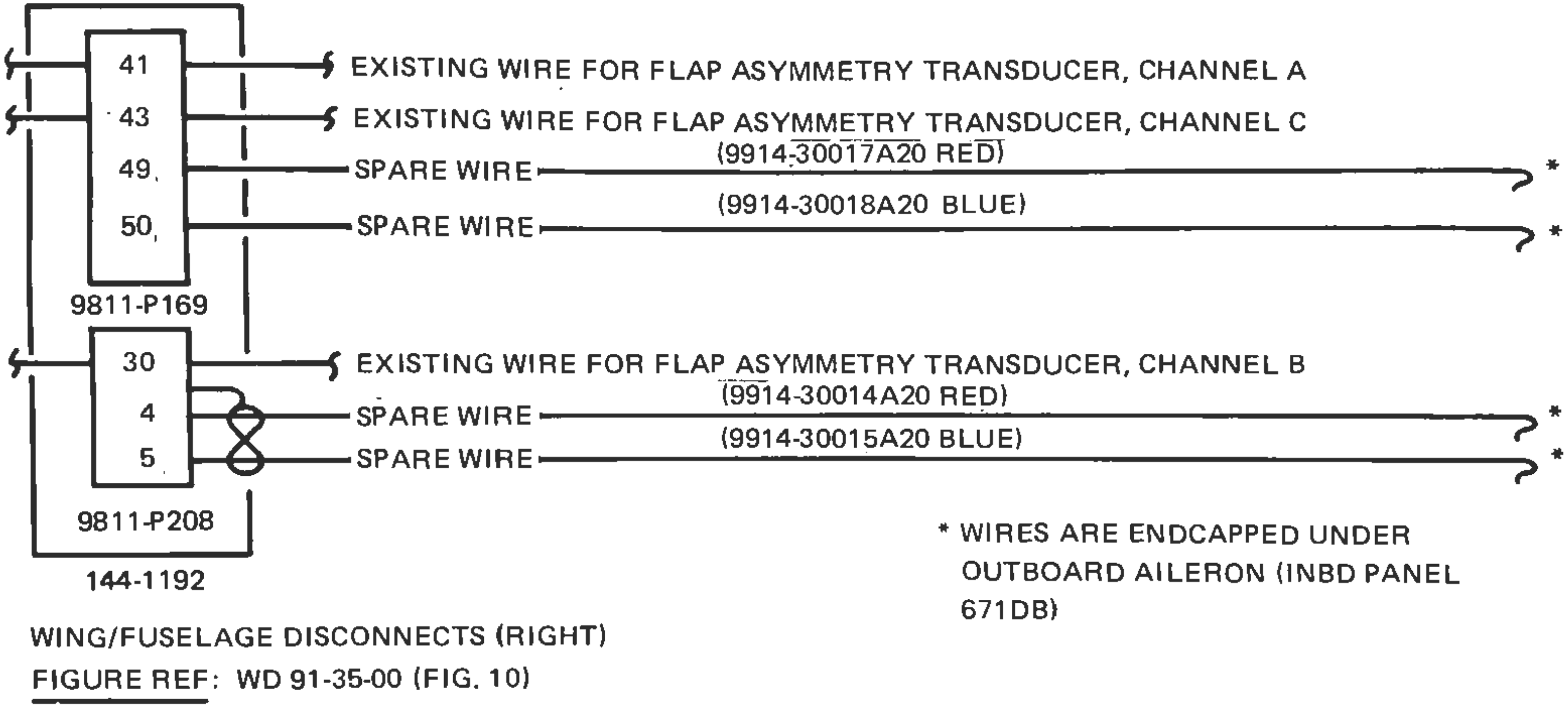
TRY TO ISOLATE WIRING FAULT IN WING. SEE FIGURE 11 FOR LOCATION OF PREVIOUS WIRING PROBLEMS.

IF WIRING FAULT DIFFICULT TO FIND, USE SPARE WIRE PER FIGURE 10 AND SUBSTITUTE FOR AFFECTED CHANNEL WIRE.


CHAN A
CHAN B
CHAN C
CHANNEL A
CHANNEL B
CHANNEL C
2
3
4
6
J2
J1
10
25
11
LEFT WING ASYMMETRY TRANSDUCER
FLAP ASYMMETRY COMPARATOR
RIGHT WING ASYMMETRY TRANSDUCER

NOTE: RESISTANCE CHECKS AT COMPARATOR WITH TRANSDUCER INSTALLED SHOULD BE EITHER 5000Ω OR OPEN. ALL TRANSDUCER CHANNELS PER WING SHOULD AGREE DURING RESISTANCE CHECKS. CHECK BOTH POLARITIES BECAUSE OF DIODES IN CIRCUIT.

Figure 9. Flap Comparator/Transducer Interface Diagram.

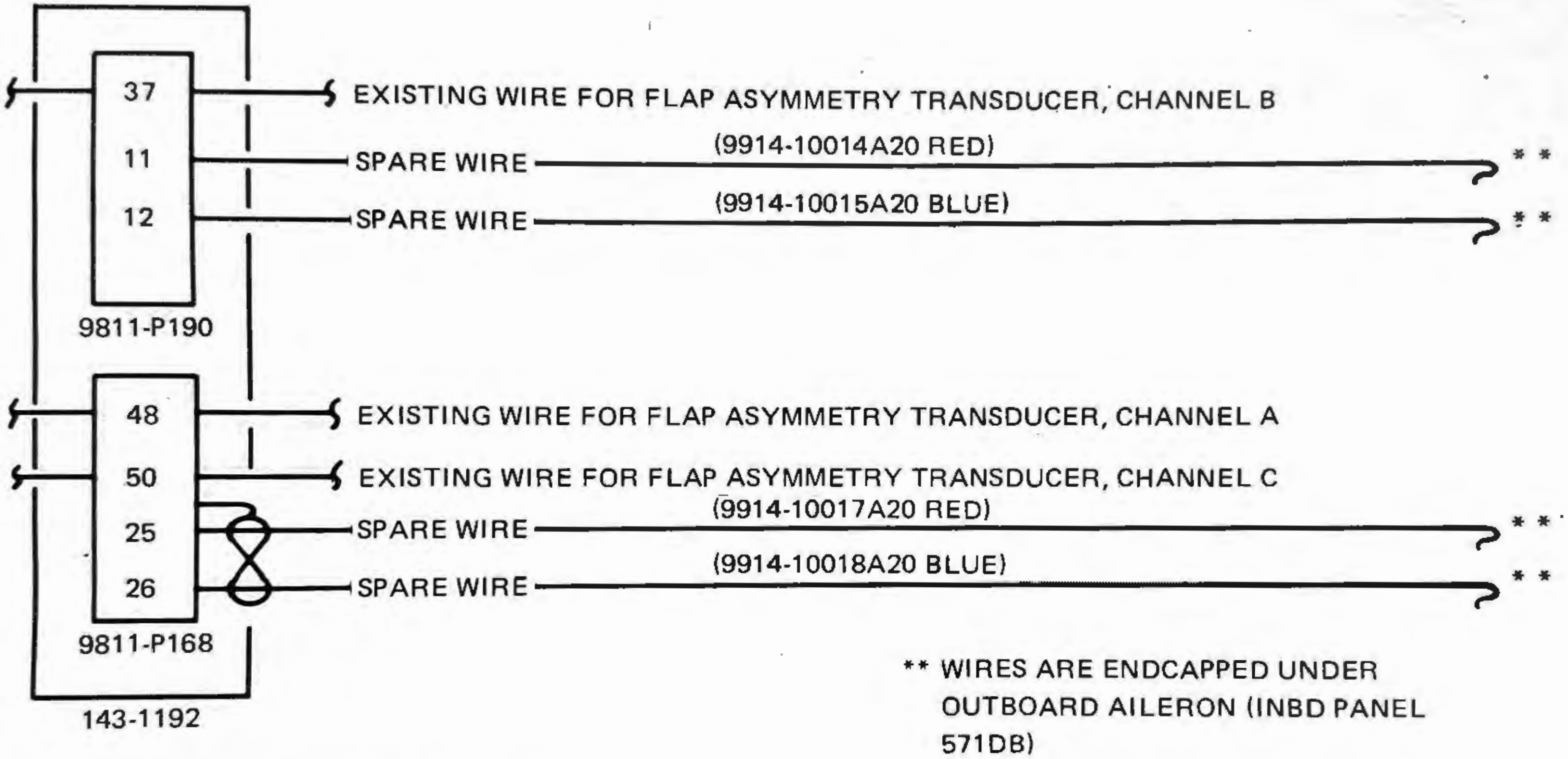

41
43
49
50
9811-P169
30
4
5
9811-P208
144-1192
EXISTING WIRE FOR FLAP ASYMMETRY TRANSDUCER, CHANNEL A
EXISTING WIRE FOR FLAP ASYMMETRY TRANSDUCER, CHANNEL C
SPARE WIRE
(9914-30017A20 RED)
*
SPARE WIRE
(9914-30018A20 BLUE)
*
EXISTING WIRE FOR FLAP ASYMMETRY TRANSDUCER, CHANNEL B
SPARE WIRE
(9914-30014A20 RED)
*
SPARE WIRE
(9914-30015A20 BLUE)
*

* WIRES ARE ENDCAPPED UNDER OUTBOARD AILERON (INBD PANEL 671DB)

WING/FUSELAGE DISCONNECTS (RIGHT)
FIGURE REF: WD 91-35-00 (FIG. 10)

(a) Right Wing.

Figure 10. Locations of Spare Wires for Flaps.

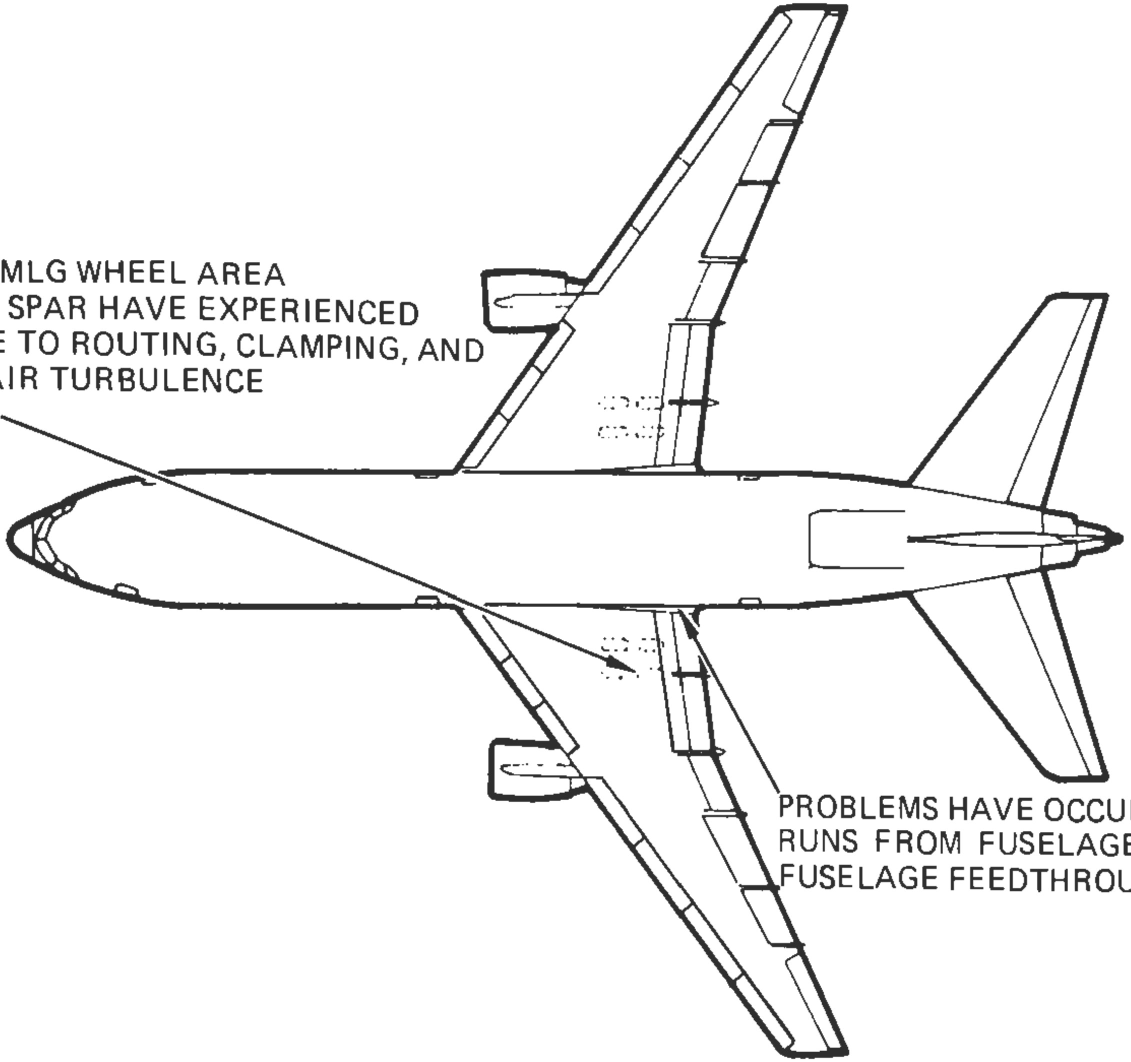


** WIRES ARE ENDCAPPED UNDER OUTBOARD AILERON (INBD PANEL 571DB)

WING/FUSELAGE DISCONNECTS (LEFT)
FIGURE REF: WD 91-35-00 (FIG. 9)

(b) Left Wing.

Figure 10. Locations of Spare Wires for Flaps (Concluded).


WIRE RUNS IN MLG WHEEL AREA AND AFT WING SPAR HAVE EXPERIENCED PROBLEMS DUE TO ROUTING, CLAMPING, AND SUBSEQUENT AIR TURBULENCE (SB 093-57-133)

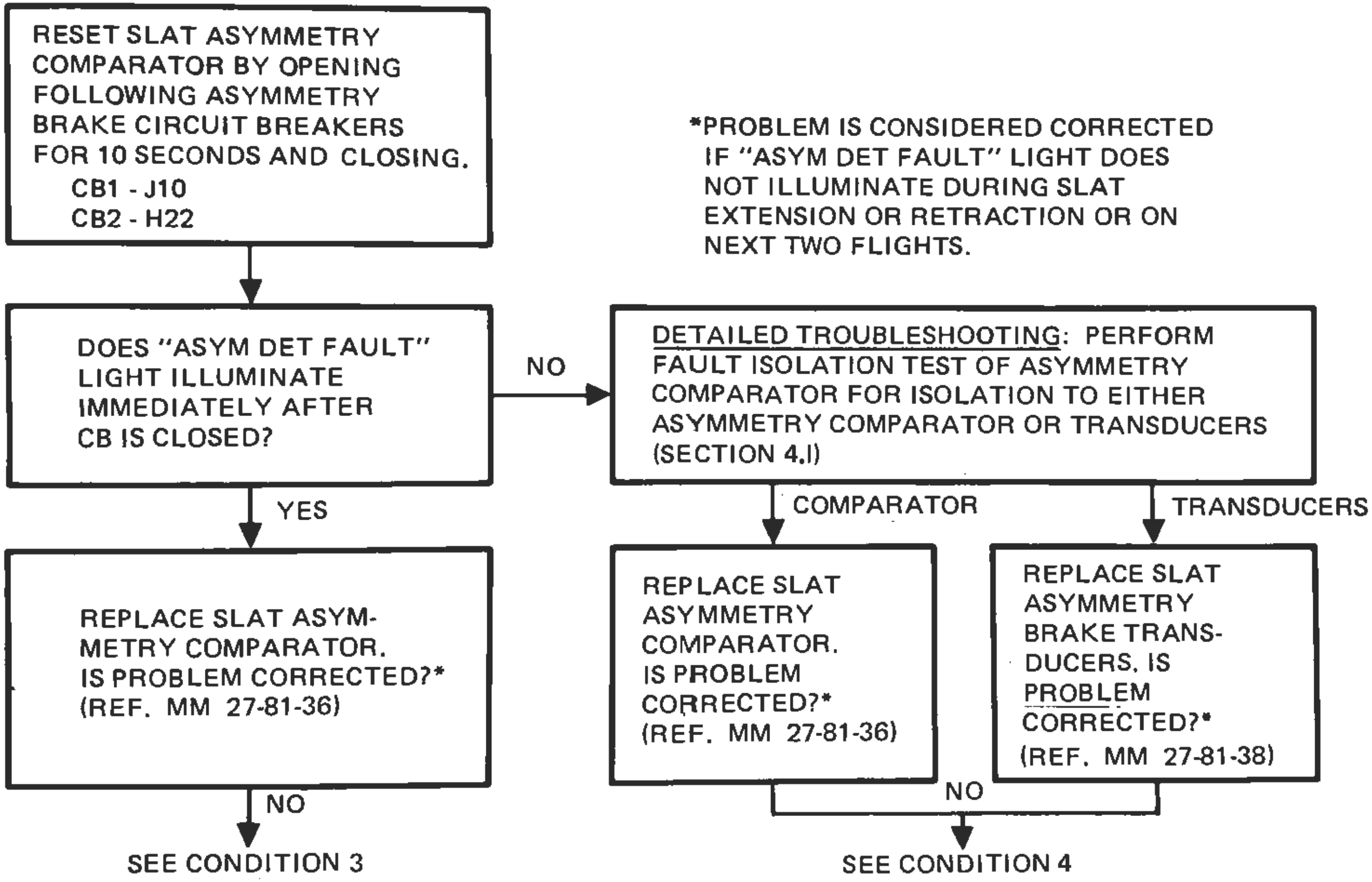
PROBLEMS HAVE OCCURRED WITH WIRE RUNS FROM FUSELAGE TO WING THROUGH FUSELAGE FEEDTHROUGHS

Figure 11. Location of Previous L-1011 Wing-Flap Wiring Problems.

4.2.2 Slat Faults

The following block diagrams outline troubleshooting procedures for faults isolated to the slat asymmetry system.

NOTE: Check slat comparator and note channel failure if problem has occurred previously.



RESET SLAT ASYMMETRY COMPARATOR BY OPENING FOLLOWING ASYMMETRY BRAKE CIRCUIT BREAKERS FOR 10 SECONDS AND CLOSING.
CB1 - J10
CB2 - H22

DOES "ASYM DET FAULT" LIGHT ILLUMINATE IMMEDIATELY AFTER CB IS CLOSED?

DETAILED TROUBLESHOOTING: PERFORM FAULT ISOLATION TEST OF ASYMMETRY COMPARATOR FOR ISOLATION TO EITHER ASYMMETRY COMPARATOR OR TRANSDUCERS (SECTION 4.I)

REPLACE SLAT ASYMMETRY COMPARATOR. IS PROBLEM CORRECTED?* (REF. MM 27-81-36)

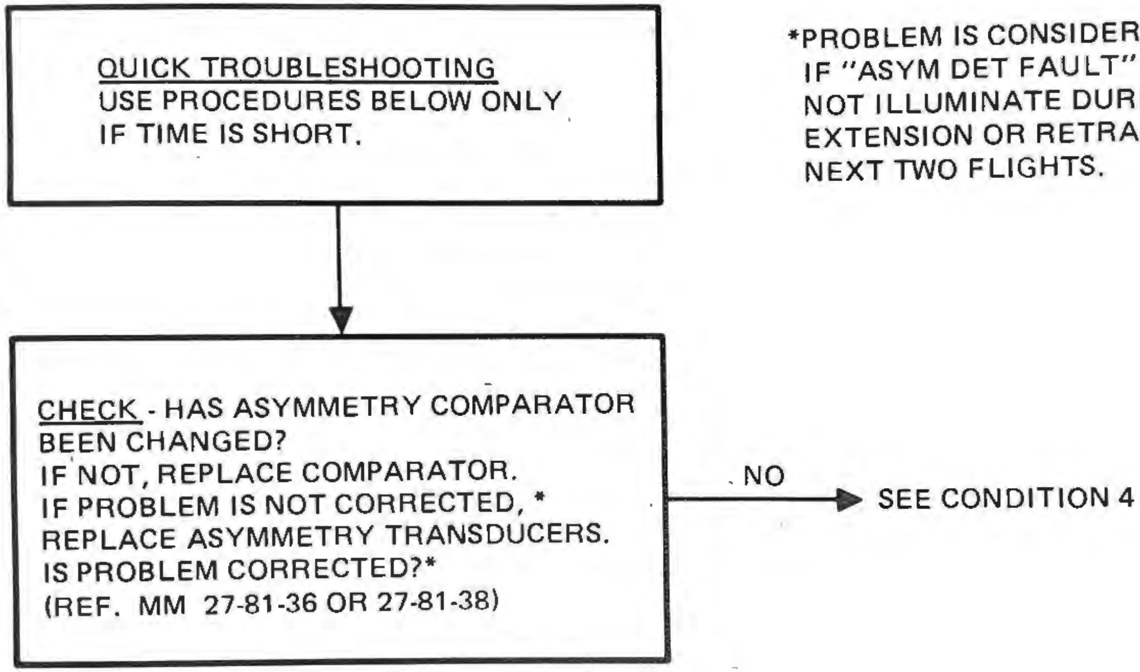
REPLACE SLAT ASYMMETRY COMPARATOR. IS PROBLEM CORRECTED?* (REF. MM 27-81-36)

REPLACE SLAT ASYMMETRY BRAKE TRANSDUCERS. IS PROBLEM CORRECTED?* (REF. MM 27-81-38)

SEE CONDITION 3

SEE CONDITION 4

*PROBLEM IS CONSIDERED CORRECTED IF "ASYM DET FAULT" LIGHT DOES NOT ILLUMINATE DURING SLAT EXTENSION OR RETRACTION OR ON NEXT TWO FLIGHTS.



QUICK TROUBLESHOOTING
USE PROCEDURES BELOW ONLY IF TIME IS SHORT.

CHECK - HAS ASYMMETRY COMPARATOR BEEN CHANGED?
IF NOT, REPLACE COMPARATOR.
IF PROBLEM IS NOT CORRECTED, *
REPLACE ASYMMETRY TRANSDUCERS.
IS PROBLEM CORRECTED?*
(REF. MM 27-81-36 OR 27-81-38)

NO → SEE CONDITION 4

*PROBLEM IS CONSIDERED CORRECTED IF "ASYM DET FAULT" LIGHT DOES NOT ILLUMINATE DURING SLAT EXTENSION OR RETRACTION OR ON NEXT TWO FLIGHTS.

Condition 3: The ASYM DET FAULT light is on, and the problem has been isolated to the slat asymmetry system. The light comes on immediately after circuit breaker reset.

This problem is typical of problems caused by either the slat asymmetry brakes (or associated wiring), the slat power drive unit (PDU) solenoids (or associated wiring), or the 28-volt power supply inputs. To isolate the problem, perform multimeter circuit checks in accordance with table 2. Troubleshoot asymmetry system circuits that do not agree with established voltage or resistance levels. Refer to L-1011 wiring diagram 27-81-01 for exact wiring and routing details. Perform circuit checks at slat asymmetry comparator connectors.

TABLE 2. LEADING-EDGE SLAT ASYMMETRY COMPARATOR CIRCUITRY

(a) VOLTAGE CHECKS. ALL VOLTAGES ARE TO GROUND.

PLUG	PIN	COMPONENT/CIRCUIT	VOLTAGE	MAINT. MAN. REF.
2781-P6	15	CIRCUIT BREAKER, CB1-J10	28 VDC	—
	3	PDU, NO. 2 SWITCHBOX-LH	28 VDC OR 0 VDC △1	27-81-08
	4	PDU, NO. 2 SWITCHBOX-LH	28 VDC OR 0 VDC △1	27-81-08
2781-P7	15	CIRCUIT BREAKER, CB2-H22	28 VDC	—
	3	PDU, NO. 1 SWITCHBOX-RH	28 VDC OR 0 VDC △1	27-81-08
	4	PDU, NO. 1 SWITCHBOX-RH	28 VDC OR 0 VDC △1	27-81-08

△1 READINGS SHOULD BE IDENTICAL: WITH SLAT STARTUP SWITCH IN AGREEMENT WITH PDU POSITION, VOLTAGE SHOULD BE 28 VDC; OTHERWISE, 0 VDC.

(b) RESISTANCE CHECKS. ALL RESISTANCES ARE TO GROUND.

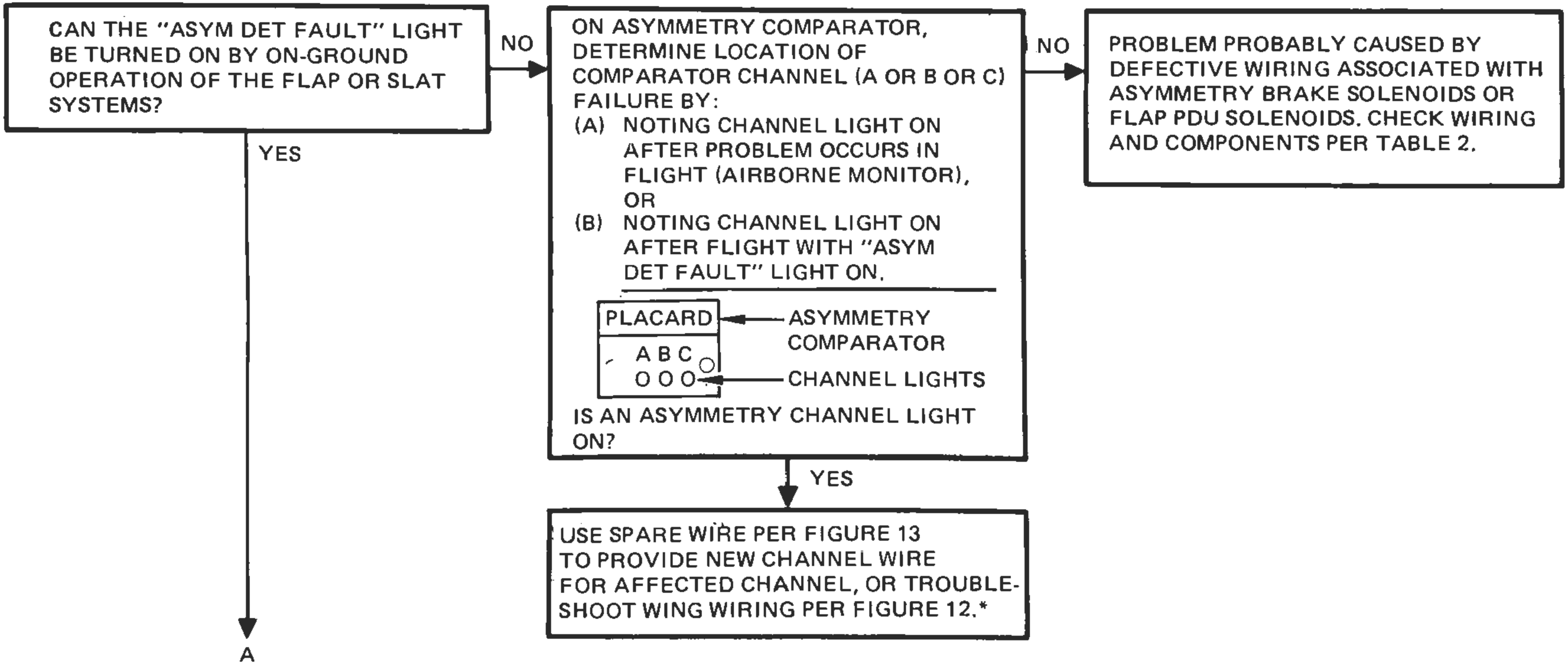
NOTE: OPEN CIRCUIT BREAKERS CB1-J10 AND CB2-H21 BEFORE TAKING NEXT CIRCUIT READING

PLUG	PIN	COMPONENT/CIRCUIT	RESISTANCE	MAINT. MAN. REF.
2781-P6	3	PDU, SHUTOFF VALVE SOLENOID NO. 1	100Ω	27-81-05
	4	PDU, SHUTOFF VALVE SOLENOID NO. 1	100Ω	27-81-05
	23	LH SLAT ASYM. BRAKE SOLENOID	20Ω	27-81-37
	27	LH SLAT ASYM. BRAKE SOLENOID	20Ω	27-81-37
2781-P7	3	PDU, SHUTOFF VALVE SOLENOID NO. 2	100Ω	27-81-05
	4	PDU, SHUTOFF VALVE SOLENOID NO. 2	100Ω	27-81-05
	23	RH SLAT ASYM. BRAKE SOLENOID	20Ω	27-81-37
	27	RH SLAT ASYM. BRAKE SOLENOID	20Ω	27-81-37

NOTE: REFER TO WIRING DIAGRAM 27-81-01 FOR DETAILED TROUBLESHOOTING OF INDIVIDUAL WIRES

Condition 4: The ASYM DET FAULT light is on, and the problem has been isolated to the slat asymmetry system. The light stays off after circuit breaker reset.

This section provides troubleshooting procedures for problems that are intermittent or problems that are difficult to isolate due to wiring problems.



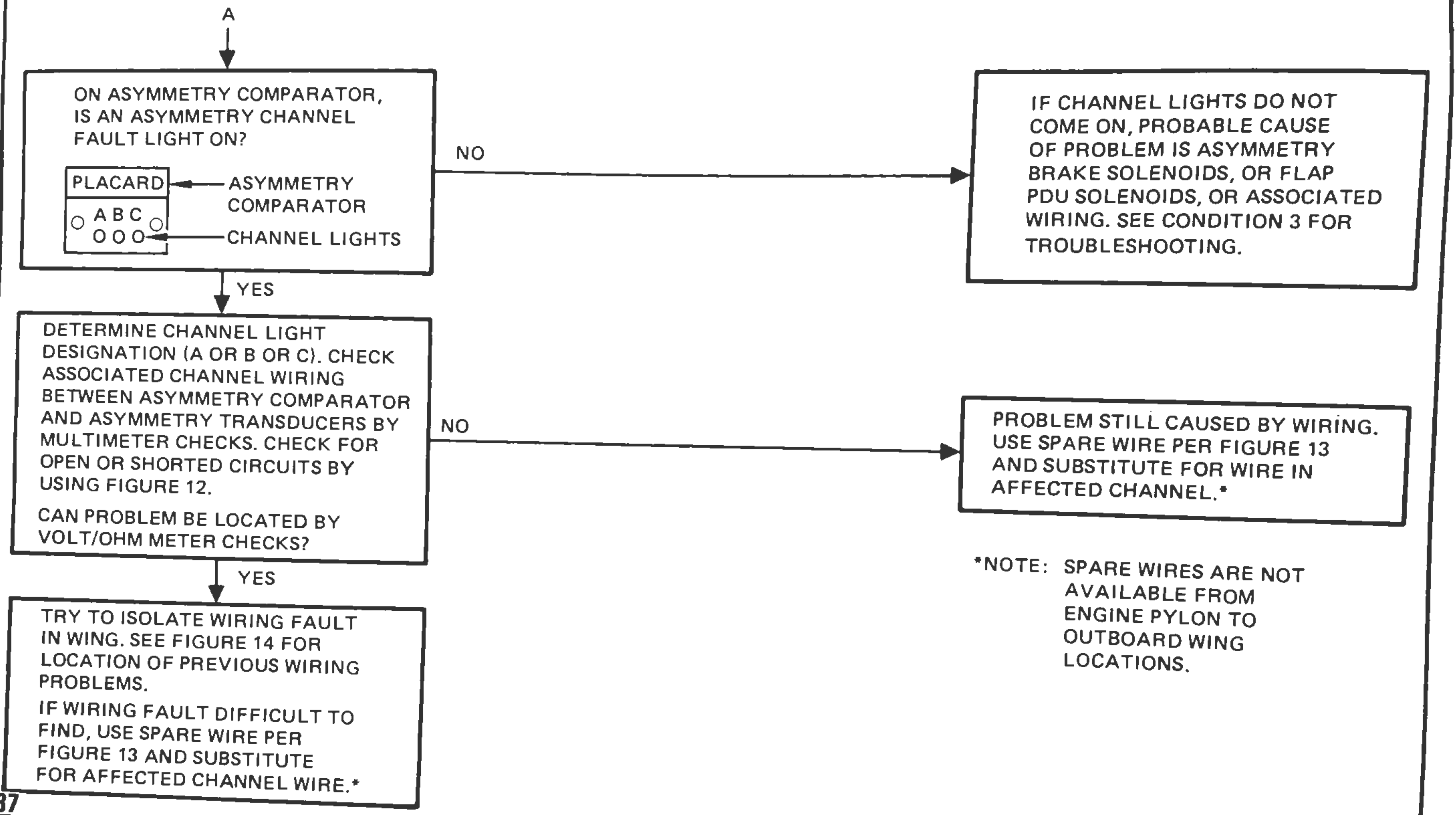
CAN THE "ASYM DET FAULT" LIGHT BE TURNED ON BY ON-GROUND OPERATION OF THE FLAP OR SLAT SYSTEMS?

ON ASYMMETRY COMPARATOR, DETERMINE LOCATION OF COMPARATOR CHANNEL (A OR B OR C) FAILURE BY:
(A) NOTING CHANNEL LIGHT ON AFTER PROBLEM OCCURS IN FLIGHT (AIRBORNE MONITOR), OR
(B) NOTING CHANNEL LIGHT ON AFTER FLIGHT WITH "ASYM DET FAULT" LIGHT ON.

IS AN ASYMMETRY CHANNEL LIGHT ON?

PROBLEM PROBABLY CAUSED BY DEFECTIVE WIRING ASSOCIATED WITH ASYMMETRY BRAKE SOLENOIDS OR FLAP PDU SOLENOIDS. CHECK WIRING AND COMPONENTS PER TABLE 2.

USE SPARE WIRE PER FIGURE 13 TO PROVIDE NEW CHANNEL WIRE FOR AFFECTED CHANNEL, OR TROUBLESHOOT WING WIRING PER FIGURE 12.*



ON ASYMMETRY COMPARATOR, IS AN ASYMMETRY CHANNEL FAULT LIGHT ON?

IF CHANNEL LIGHTS DO NOT COME ON, PROBABLE CAUSE OF PROBLEM IS ASYMMETRY BRAKE SOLENOIDS, OR FLAP PDU SOLENOIDS, OR ASSOCIATED WIRING. SEE CONDITION 3 FOR TROUBLESHOOTING.

DETERMINE CHANNEL LIGHT DESIGNATION (A OR B OR C). CHECK ASSOCIATED CHANNEL WIRING BETWEEN ASYMMETRY COMPARATOR AND ASYMMETRY TRANSDUCERS BY MULTIMETER CHECKS. CHECK FOR OPEN OR SHORTED CIRCUITS BY USING FIGURE 12.

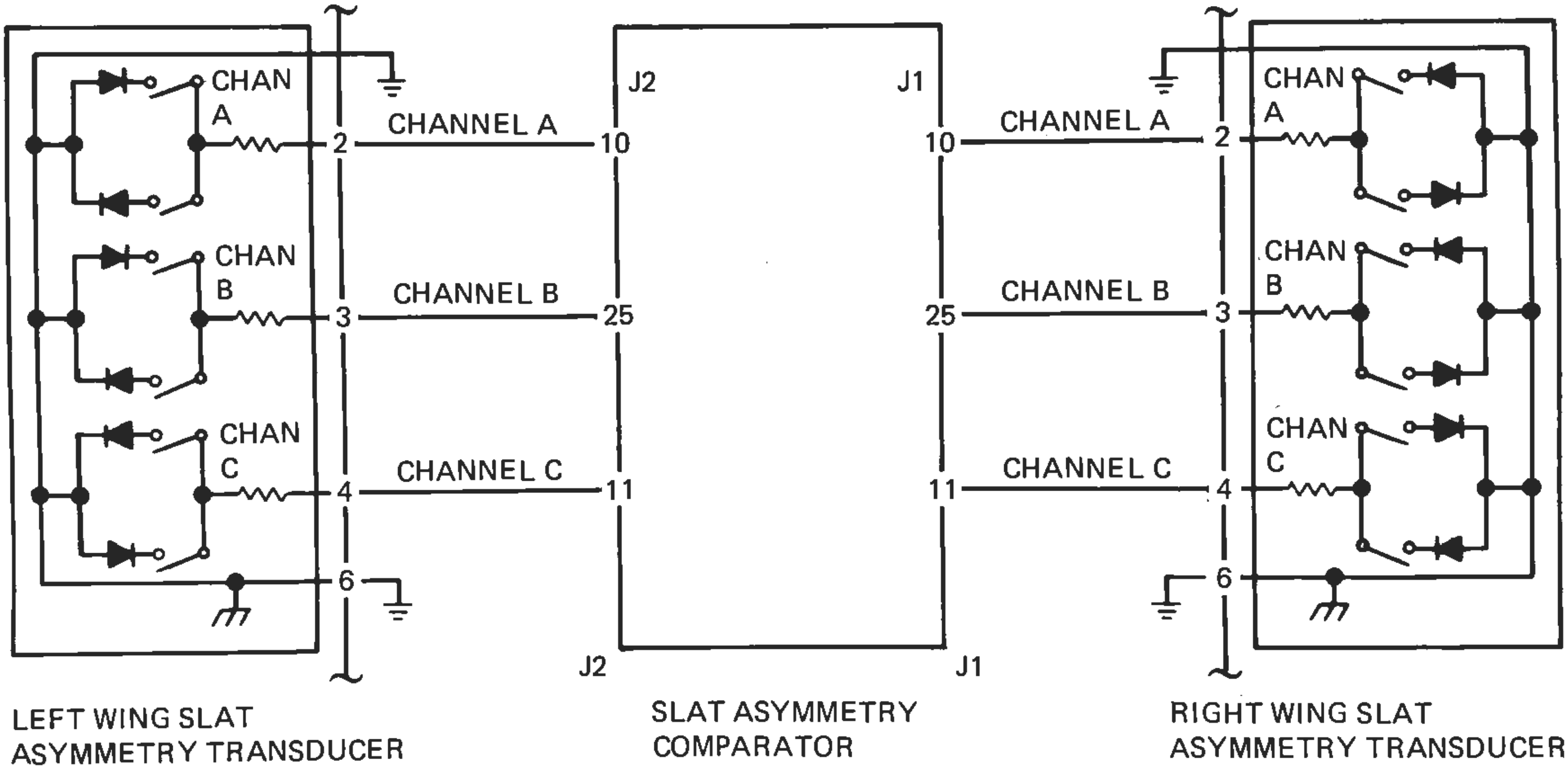
CAN PROBLEM BE LOCATED BY VOLT/OHM METER CHECKS?

PROBLEM STILL CAUSED BY WIRING. USE SPARE WIRE PER FIGURE 13 AND SUBSTITUTE FOR WIRE IN AFFECTED CHANNEL.*

TRY TO ISOLATE WIRING FAULT IN WING. SEE FIGURE 14 FOR LOCATION OF PREVIOUS WIRING PROBLEMS.

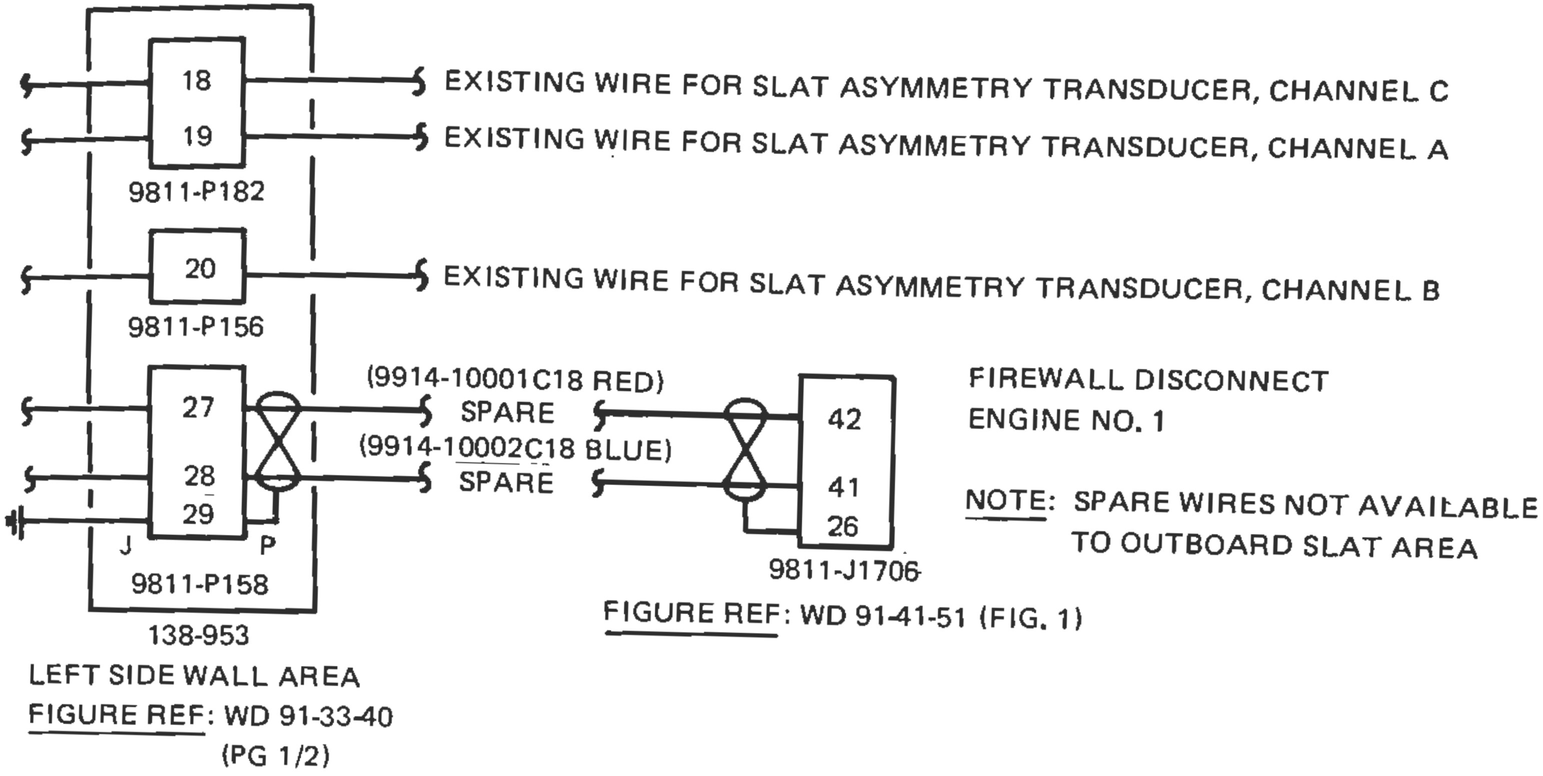
IF WIRING FAULT DIFFICULT TO FIND, USE SPARE WIRE PER FIGURE 13 AND SUBSTITUTE FOR AFFECTED CHANNEL WIRE.*

*NOTE: SPARE WIRES ARE NOT AVAILABLE FROM ENGINE PYLON TO OUTBOARD WING LOCATIONS.


CHAN A
CHAN B
CHAN C
CHANNEL A
CHANNEL B
CHANNEL C
2
3
4
6
10
25
11
J2
J1
LEFT WING SLAT ASYMMETRY TRANSDUCER
SLAT ASYMMETRY COMPARATOR
RIGHT WING SLAT ASYMMETRY TRANSDUCER

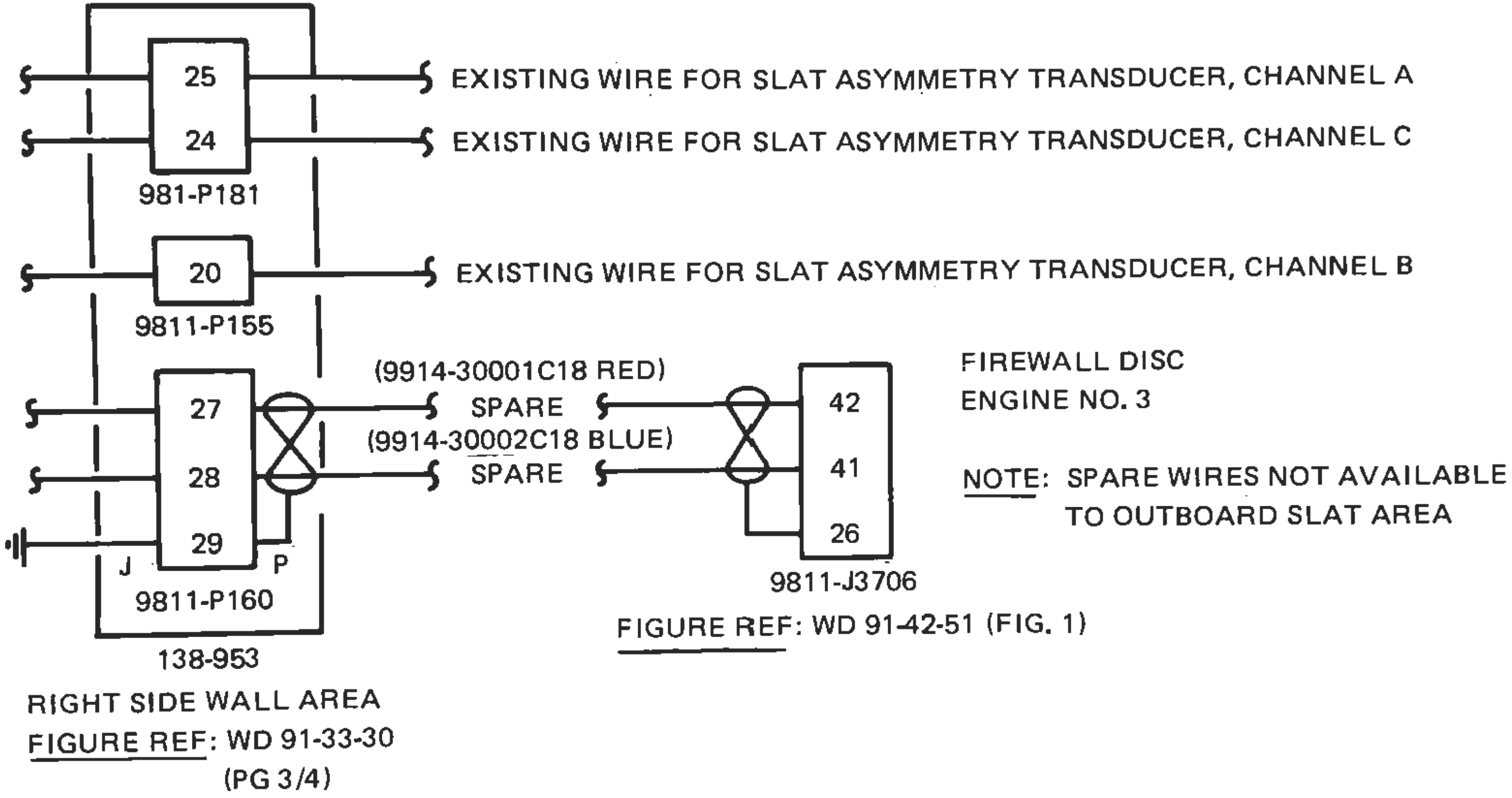
NOTE: RESISTANCE CHECKS AT COMPARATOR WITH TRANSDUCER INSTALLED SHOULD BE 5000Ω OR OPEN. ALL TRANSDUCER CHANNELS PER WING SHOULD AGREE DURING RESISTANCE CHECKS. CHECK BOTH POLARITIES BECAUSE OF DIODES IN CIRCUIT.

Figure 12. Slat Comparator/Transducer Interface Diagram.


18
19
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL C
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL A
9811-P182
20
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL B
9811-P156
27
28
29
J
P
9811-P158
138-953
LEFT SIDE WALL AREA
FIGURE REF: WD 91-33-40
(PG 1/2)
(9914-10001C18 RED)
SPARE
(9914-10002C18 BLUE)
SPARE
42
41
26
9811-J1706
FIGURE REF: WD 91-41-51 (FIG. 1)
FIREWALL DISCONNECT
ENGINE NO. 1
NOTE: SPARE WIRES NOT AVAILABLE
TO OUTBOARD SLAT AREA

(a) Left Wing.

Figure 13. Locations of Spare Wires for Slats.


25
24
981-P181
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL A
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL C
20
9811-P155
EXISTING WIRE FOR SLAT ASYMMETRY TRANSDUCER, CHANNEL B
27
28
29
J
P
9811-P160
138-953
RIGHT SIDE WALL AREA
FIGURE REF: WD 91-33-30 (PG 3/4)
(9914-30001C18 RED)
SPARE
(9914-30002C18 BLUE)
SPARE
42
41
26
9811-J3706
FIGURE REF: WD 91-42-51 (FIG. 1)
FIREWALL DISC
ENGINE NO. 3
NOTE: SPARE WIRES NOT AVAILABLE TO OUTBOARD SLAT AREA

(b) Right Wing.

Figure 13. Locations of Spare Wires for Slats (Concluded).

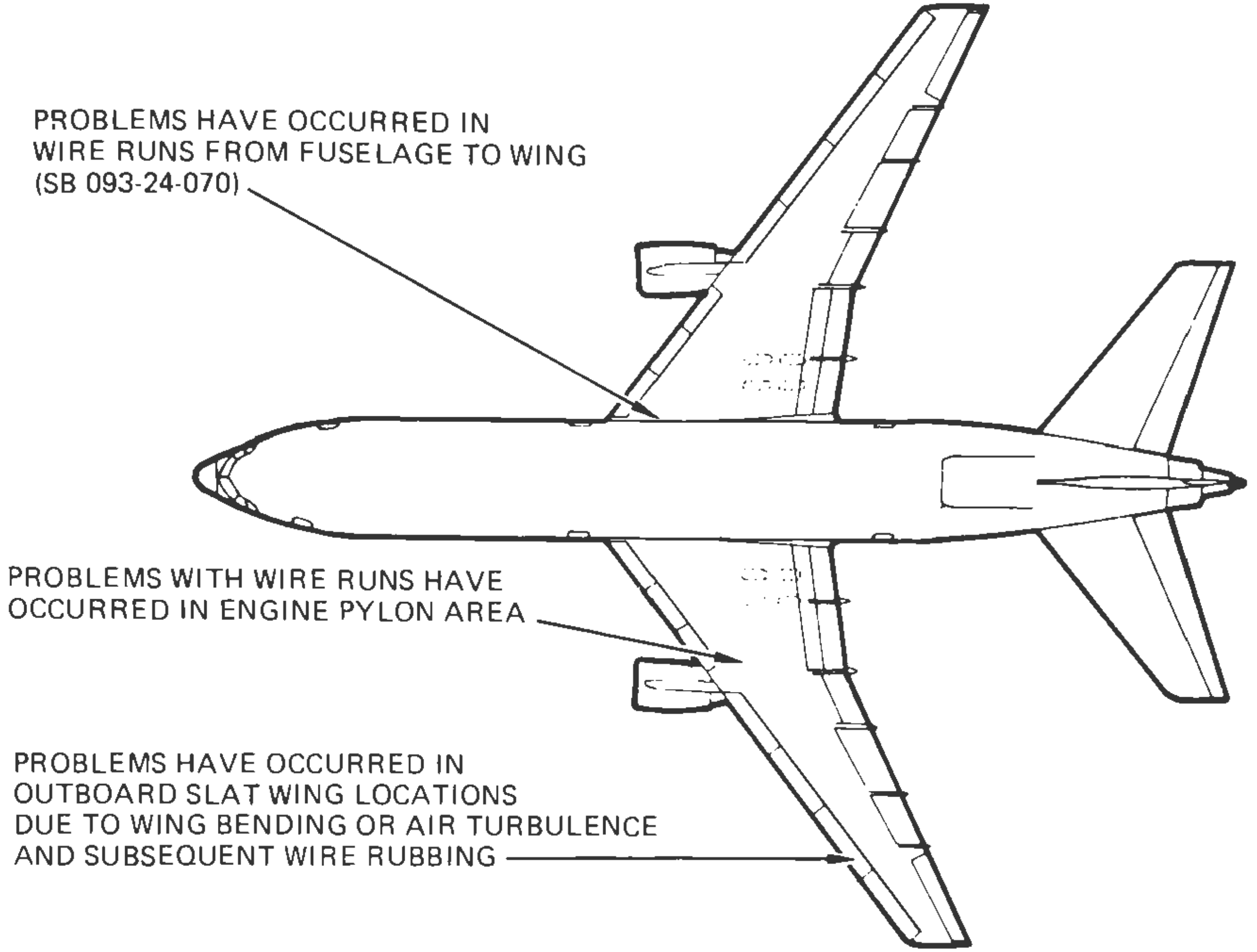

PROBLEMS HAVE OCCURRED IN
WIRE RUNS FROM FUSELAGE TO WING
(SB 093-24-070)
PROBLEMS WITH WIRE RUNS HAVE
OCCURRED IN ENGINE PYLON AREA
PROBLEMS HAVE OCCURRED IN
OUTBOARD SLAT WING LOCATIONS
DUE TO WING BENDING OR AIR TURBULENCE
AND SUBSEQUENT WIRE RUBBING

Figure 14. Location of Previous L-1011 Wing-Slat Wiring Problems.

NOTES:

SECTION 5.0

LOCK LIGHT PROBLEMS

This section provides troubleshooting procedures for problems that can cause the trailing edge lock light (flaps) or leading edge lock light (slats) to illuminate. Section 5.1 should be used for fault isolation of problems that cause a flap lock light problem, and section 5.2 should be used for isolation of problems that cause a slat lock light problem.

5.1 FLAP FAULTS

5.1.1 Troubleshooting Procedures

The flight engineer/second officer's (FE/SO's) flight station and the flap lock lights are depicted in figure 15. The procedures in the following block diagram should be used for fault isolation of problems that cause a flap lock light to illuminate.

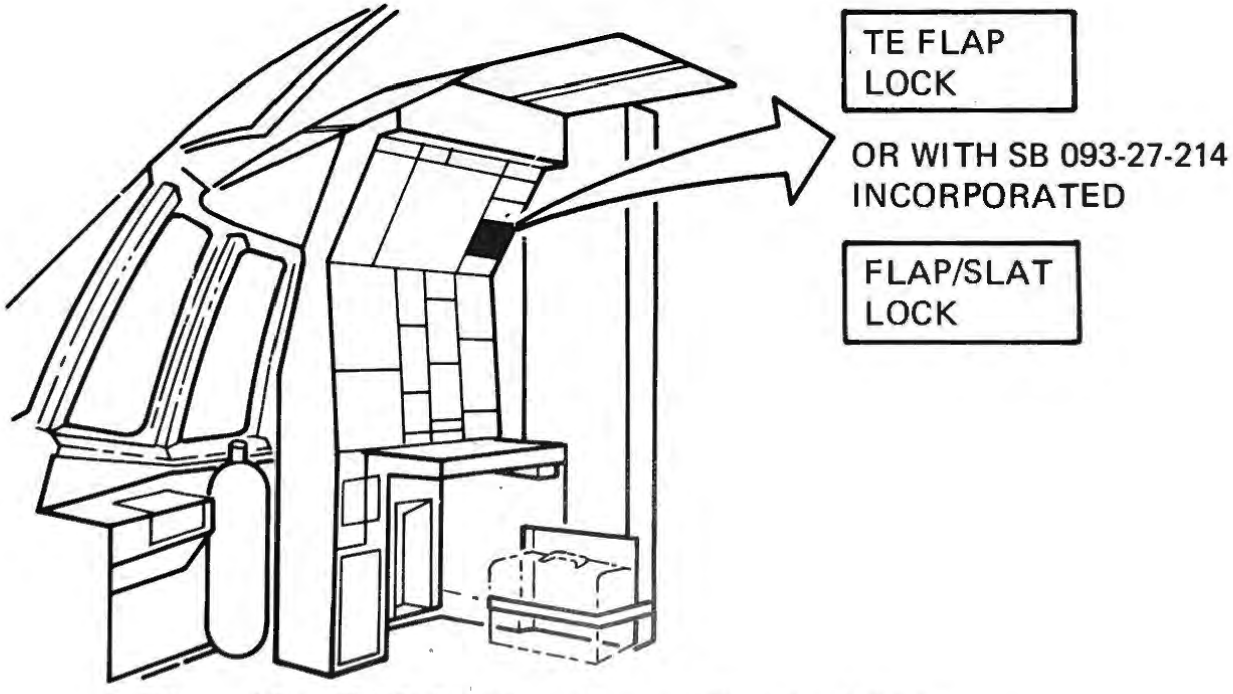
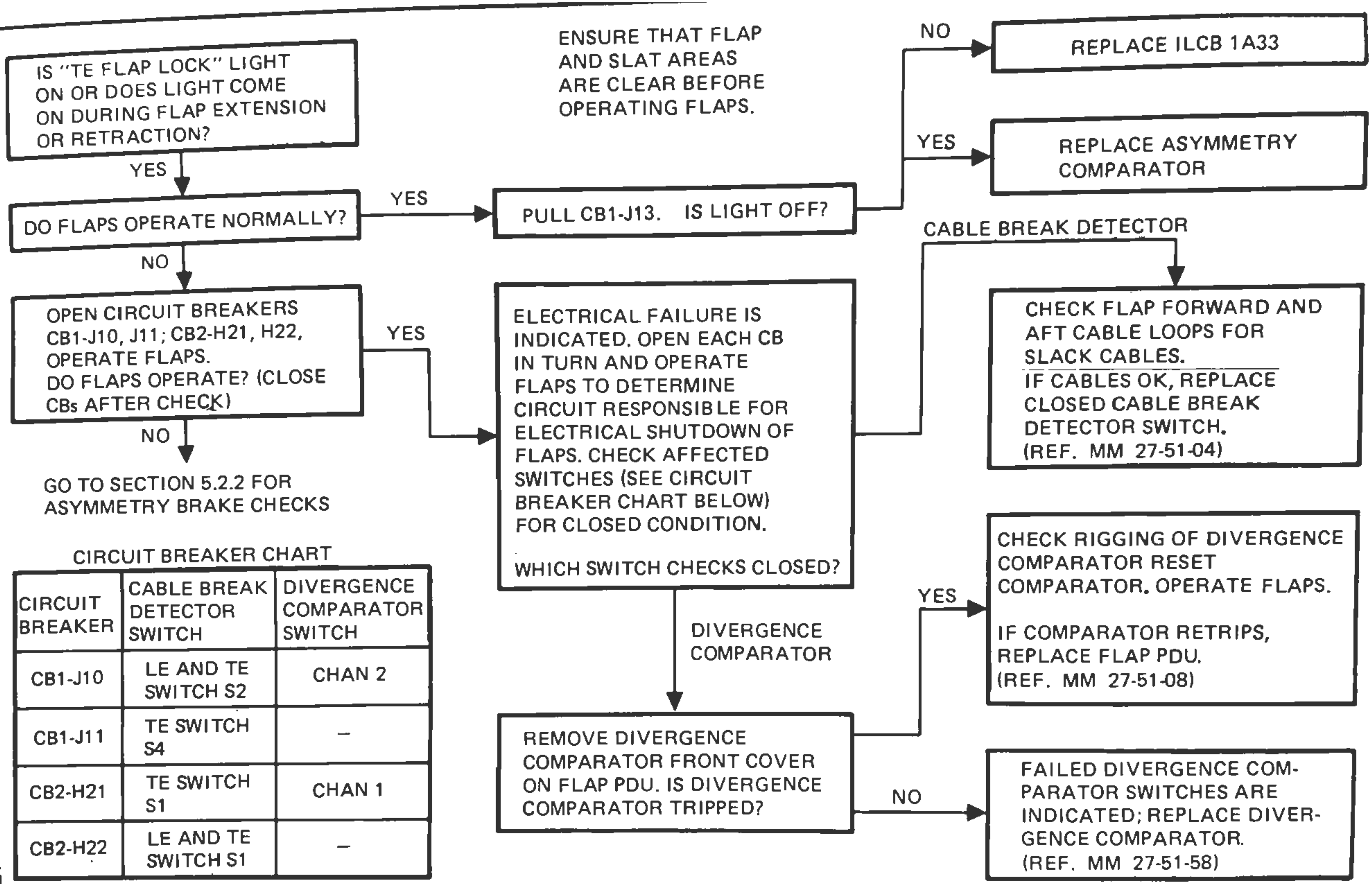


Figure 15. FE/SO Flight Station and Flap Lock Lights.


IS "TE FLAP LOCK" LIGHT ON OR DOES LIGHT COME ON DURING FLAP EXTENSION OR RETRACTION?
YES
DO FLAPS OPERATE NORMALLY?
YES
PULL CB1-J13. IS LIGHT OFF?
NO
REPLACE ILCB 1A33
YES
REPLACE ASYMMETRY COMPARATOR
ENSURE THAT FLAP AND SLAT AREAS ARE CLEAR BEFORE OPERATING FLAPS.
NO
OPEN CIRCUIT BREAKERS CB1-J10, J11; CB2-H21, H22, OPERATE FLAPS. DO FLAPS OPERATE? (CLOSE CBs AFTER CHECK)
YES
NO
GO TO SECTION 5.2.2 FOR ASYMMETRY BRAKE CHECKS
ELECTRICAL FAILURE IS INDICATED. OPEN EACH CB IN TURN AND OPERATE FLAPS TO DETERMINE CIRCUIT RESPONSIBLE FOR ELECTRICAL SHUTDOWN OF FLAPS. CHECK AFFECTED SWITCHES (SEE CIRCUIT BREAKER CHART BELOW) FOR CLOSED CONDITION.
WHICH SWITCH CHECKS CLOSED?
CABLE BREAK DETECTOR
CHECK FLAP FORWARD AND AFT CABLE LOOPS FOR SLACK CABLES.
IF CABLES OK, REPLACE CLOSED CABLE BREAK DETECTOR SWITCH. (REF. MM 27-51-04)
DIVERGENCE COMPARATOR
REMOVE DIVERGENCE COMPARATOR FRONT COVER ON FLAP PDU. IS DIVERGENCE COMPARATOR TRIPPED?
YES
CHECK RIGGING OF DIVERGENCE COMPARATOR RESET COMPARATOR. OPERATE FLAPS.
IF COMPARATOR RETRIPS, REPLACE FLAP PDU. (REF. MM 27-51-08)
NO
FAILED DIVERGENCE COMPARATOR SWITCHES ARE INDICATED; REPLACE DIVERGENCE COMPARATOR. (REF. MM 27-51-58)

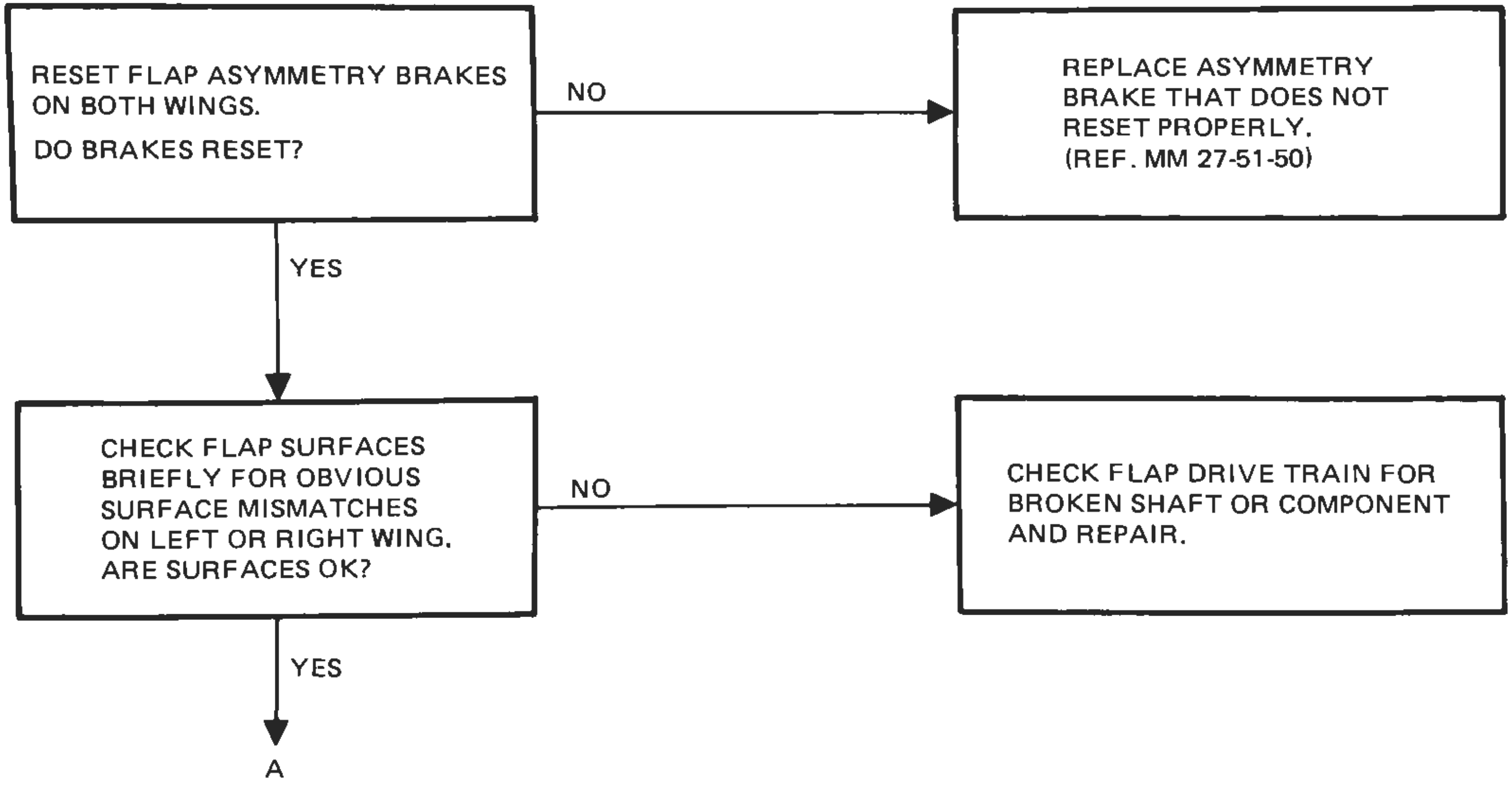
CIRCUIT BREAKER CHART

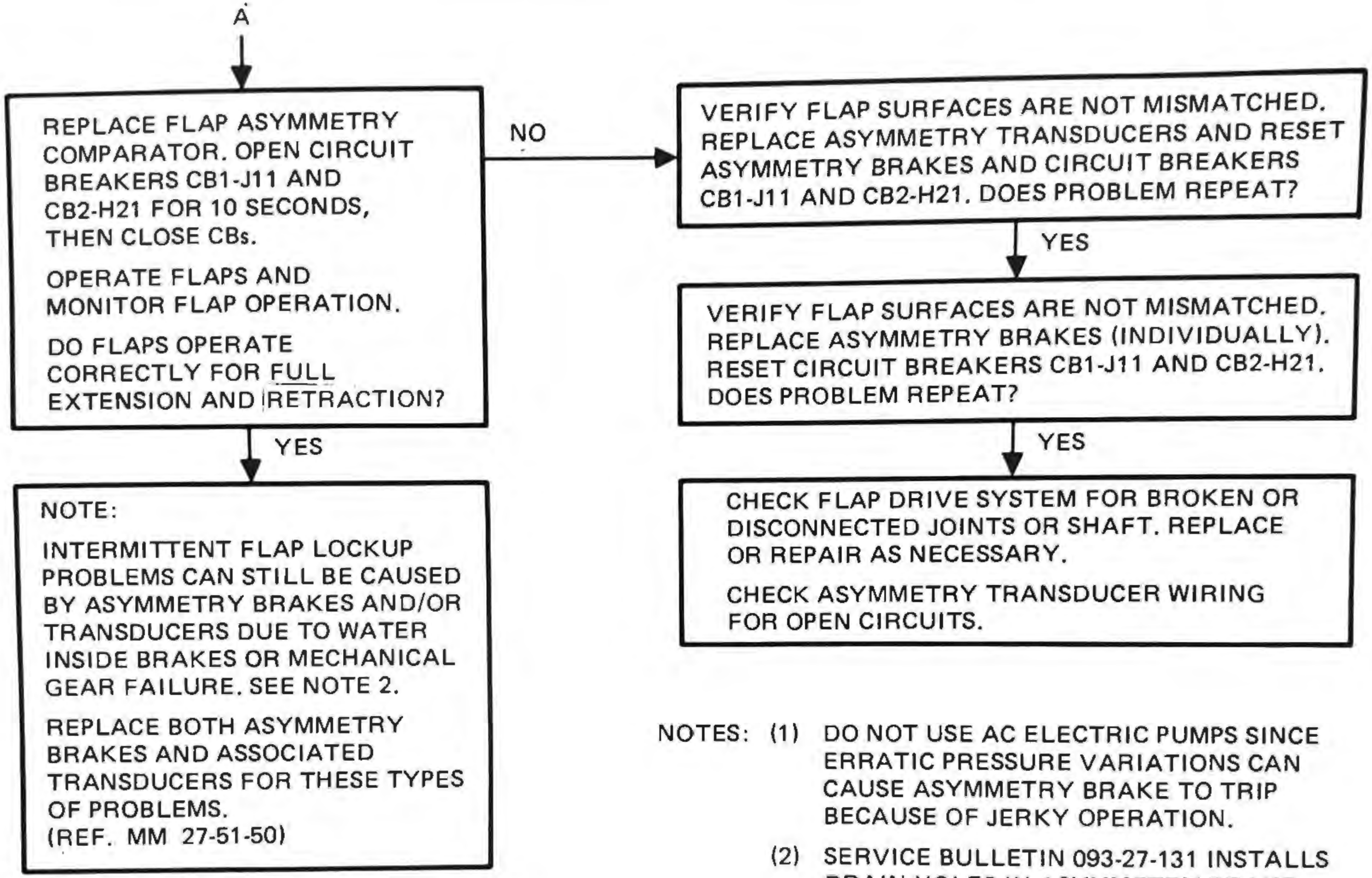
CIRCUIT BREAKER	CABLE BREAK DETECTOR SWITCH	DIVERGENCE COMPARATOR SWITCH
CB1-J10	LE AND TE SWITCH S2	CHAN 2
CB1-J11	TE SWITCH S4	–
CB2-H21	TE SWITCH S1	CHAN 1
CB2-H22	LE AND TE SWITCH S1	–

5.1.2 Asymmetry Brake Checks

The following procedures are designed to troubleshoot asymmetry system flap lockups caused by false asymmetry trips or actual surface out-of-asymmetry conditions.

Problem Symptom: **Flap lock light on and asymmetry brakes tripped.**


RESET FLAP ASYMMETRY BRAKES ON BOTH WINGS.
DO BRAKES RESET?
NO
REPLACE ASYMMETRY BRAKE THAT DOES NOT RESET PROPERLY. (REF. MM 27-51-50)
YES
CHECK FLAP SURFACES BRIEFLY FOR OBVIOUS SURFACE MISMATCHES ON LEFT OR RIGHT WING. ARE SURFACES OK?
NO
CHECK FLAP DRIVE TRAIN FOR BROKEN SHAFT OR COMPONENT AND REPAIR.
YES
A



REPLACE FLAP ASYMMETRY COMPARATOR. OPEN CIRCUIT BREAKERS CB1-J11 AND CB2-H21 FOR 10 SECONDS, THEN CLOSE CBs.

OPERATE FLAPS AND MONITOR FLAP OPERATION.

DO FLAPS OPERATE CORRECTLY FOR FULL EXTENSION AND RETRACTION?

NOTE:

INTERMITTENT FLAP LOCKUP PROBLEMS CAN STILL BE CAUSED BY ASYMMETRY BRAKES AND/OR TRANSDUCERS DUE TO WATER INSIDE BRAKES OR MECHANICAL GEAR FAILURE. SEE NOTE 2.

REPLACE BOTH ASYMMETRY BRAKES AND ASSOCIATED TRANSDUCERS FOR THESE TYPES OF PROBLEMS.
(REF. MM 27-51-50)

VERIFY FLAP SURFACES ARE NOT MISMATCHED. REPLACE ASYMMETRY TRANSDUCERS AND RESET ASYMMETRY BRAKES AND CIRCUIT BREAKERS CB1-J11 AND CB2-H21. DOES PROBLEM REPEAT?

VERIFY FLAP SURFACES ARE NOT MISMATCHED. REPLACE ASYMMETRY BRAKES (INDIVIDUALLY). RESET CIRCUIT BREAKERS CB1-J11 AND CB2-H21. DOES PROBLEM REPEAT?

CHECK FLAP DRIVE SYSTEM FOR BROKEN OR DISCONNECTED JOINTS OR SHAFT. REPLACE OR REPAIR AS NECESSARY.

CHECK ASYMMETRY TRANSDUCER WIRING FOR OPEN CIRCUITS.

NOTES: (1) DO NOT USE AC ELECTRIC PUMPS SINCE ERRATIC PRESSURE VARIATIONS CAN CAUSE ASYMMETRY BRAKE TO TRIP BECAUSE OF JERKY OPERATION.

(2) SERVICE BULLETIN 093-27-131 INSTALLS DRAIN HOLES IN ASYMMETRY BRAKE TO PREVENT WATER ACCUMULATION AND SUBSEQUENT FREEZING AND/OR TRANSDUCER WATER PROBLEMS.

5.2 SLAT FAULTS

5.2.1 Troubleshooting Procedures

The following procedures should be used for fault isolation of problems that cause a slat lock light to illuminate.

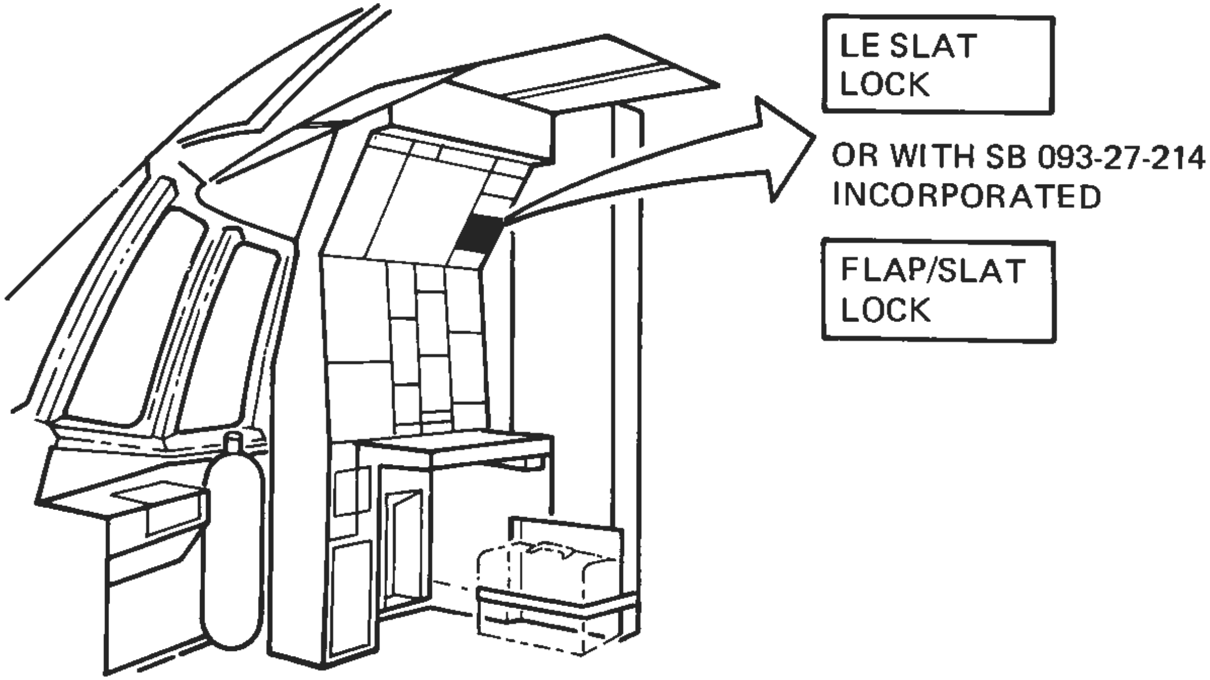
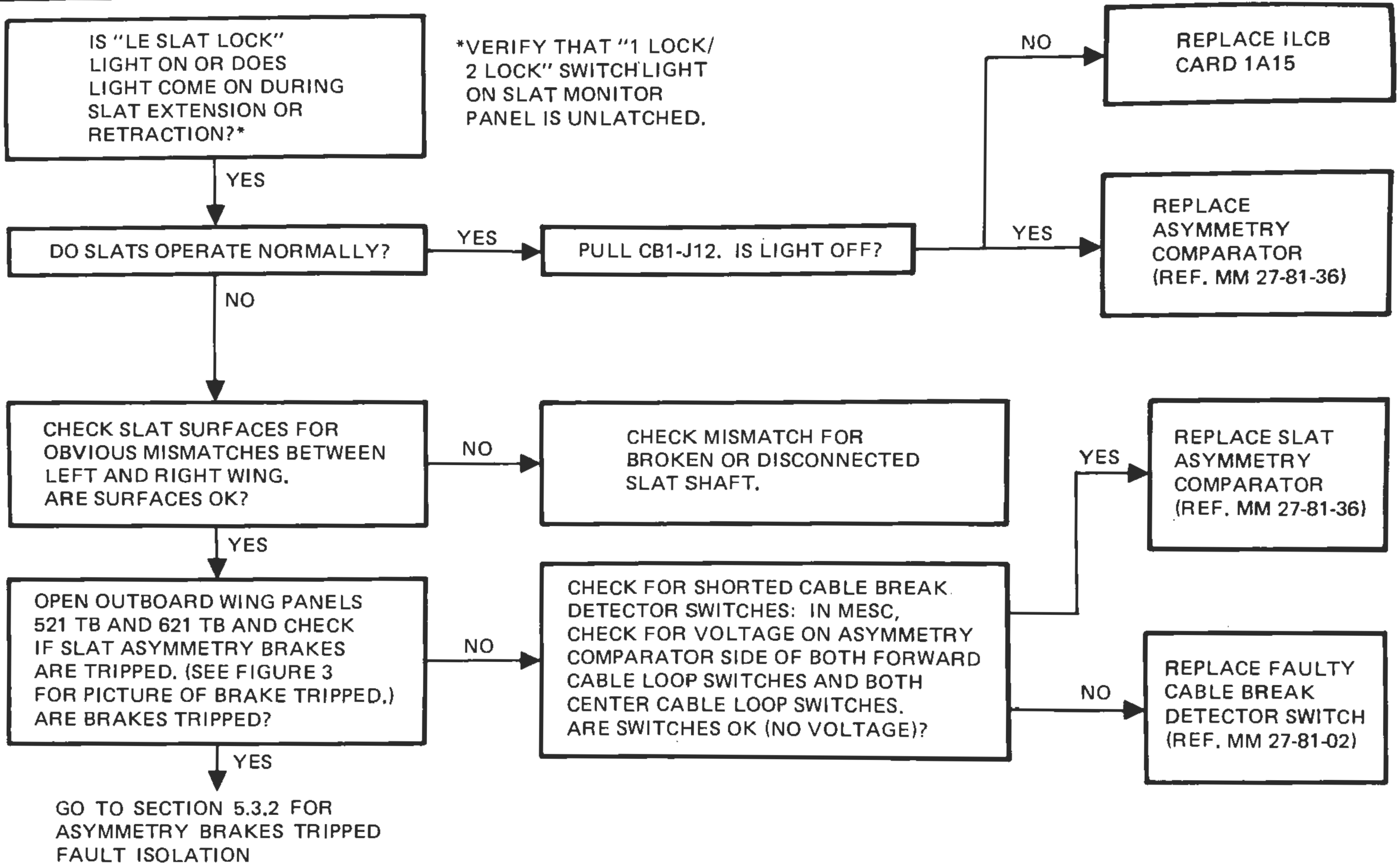


Figure 16. FE/SO Flight Station and Slat Lock Lights.

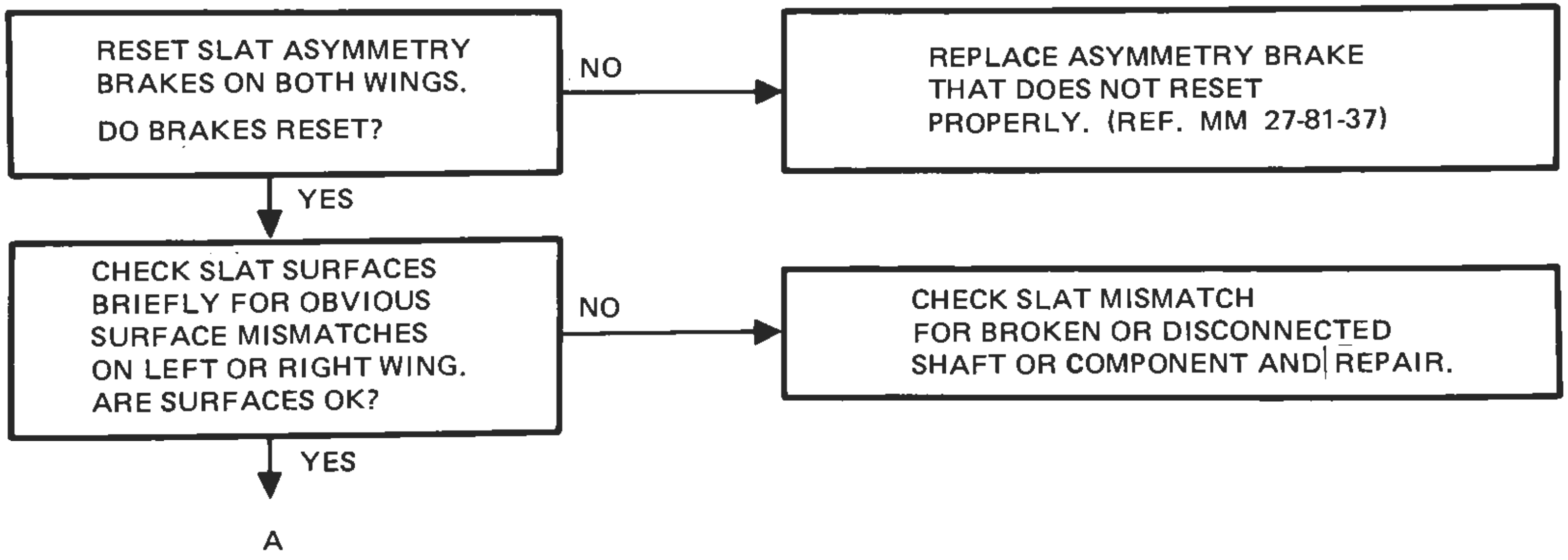

IS "LE SLAT LOCK" LIGHT ON OR DOES LIGHT COME ON DURING SLAT EXTENSION OR RETRACTION?*
YES
DO SLATS OPERATE NORMALLY?
YES
PULL CB1-J12. IS LIGHT OFF?
NO
REPLACE ILCB CARD 1A15
YES
REPLACE ASYMMETRY COMPARATOR (REF. MM 27-81-36)
NO
CHECK SLAT SURFACES FOR OBVIOUS MISMATCHES BETWEEN LEFT AND RIGHT WING. ARE SURFACES OK?
NO
CHECK MISMATCH FOR BROKEN OR DISCONNECTED SLAT SHAFT.
YES
OPEN OUTBOARD WING PANELS 521 TB AND 621 TB AND CHECK IF SLAT ASYMMETRY BRAKES ARE TRIPPED. (SEE FIGURE 3 FOR PICTURE OF BRAKE TRIPPED.) ARE BRAKES TRIPPED?
NO
CHECK FOR SHORTED CABLE BREAK DETECTOR SWITCHES: IN MESC, CHECK FOR VOLTAGE ON ASYMMETRY COMPARATOR SIDE OF BOTH FORWARD CABLE LOOP SWITCHES AND BOTH CENTER CABLE LOOP SWITCHES. ARE SWITCHES OK (NO VOLTAGE)?
YES
REPLACE SLAT ASYMMETRY COMPARATOR (REF. MM 27-81-36)
NO
REPLACE FAULTY CABLE BREAK DETECTOR SWITCH (REF. MM 27-81-02)
YES
GO TO SECTION 5.3.2 FOR ASYMMETRY BRAKES TRIPPED FAULT ISOLATION

*VERIFY THAT "1 LOCK/ 2 LOCK" SWITCH LIGHT ON SLAT MONITOR PANEL IS UNLATCHED.

5.2.2 Asymmetry Brake Checks

The following procedures are designed to troubleshoot slat asymmetry system lockups caused by false asymmetry trips or actual surface out-of-asymmetry conditions.

Problem Symptom: Slat lock light on and asymmetry brakes tripped.

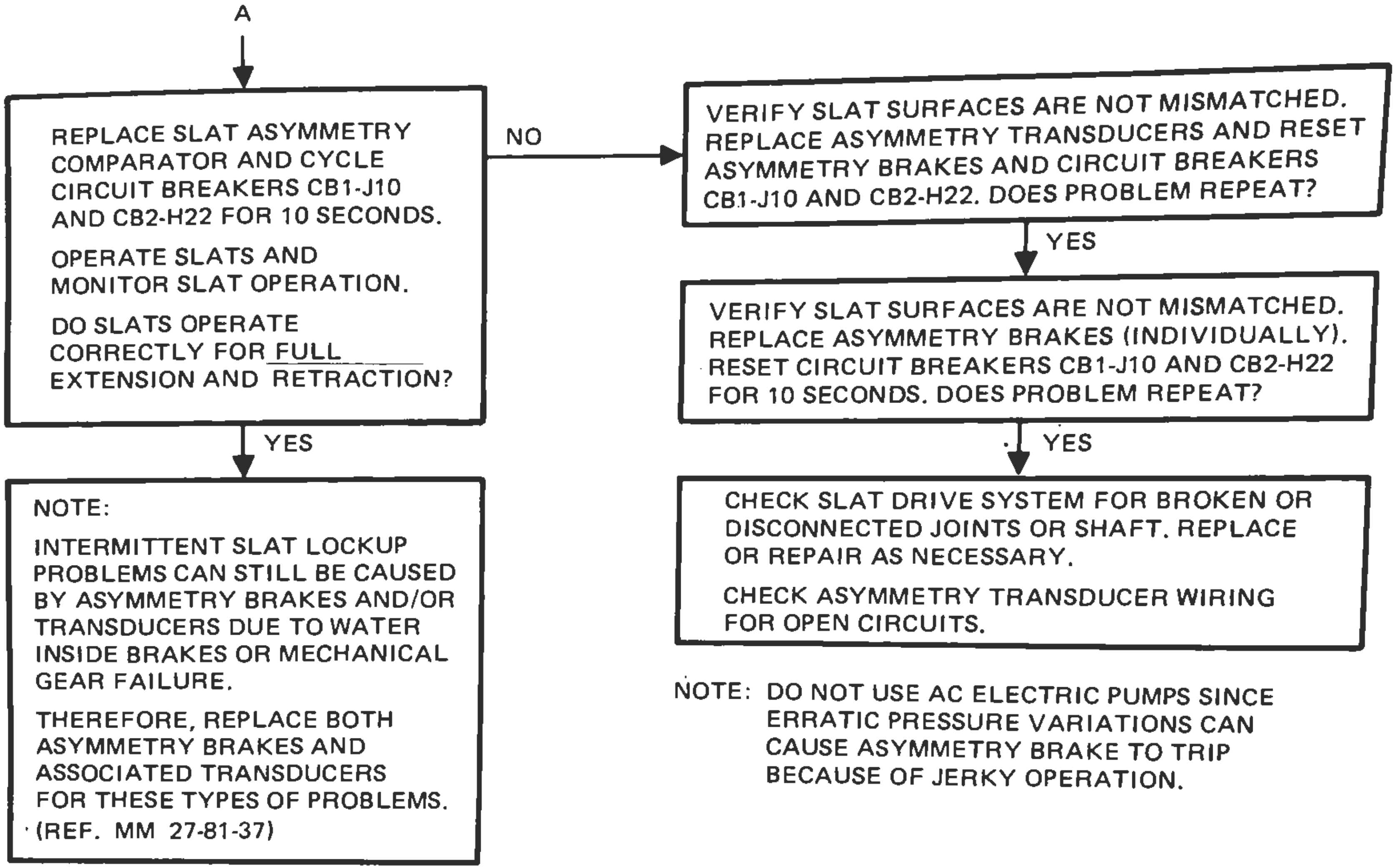


RESET SLAT ASYMMETRY BRAKES ON BOTH WINGS.
DO BRAKES RESET?

REPLACE ASYMMETRY BRAKE THAT DOES NOT RESET PROPERLY. (REF. MM 27-81-37)

CHECK SLAT SURFACES BRIEFLY FOR OBVIOUS SURFACE MISMATCHES ON LEFT OR RIGHT WING.
ARE SURFACES OK?

CHECK SLAT MISMATCH FOR BROKEN OR DISCONNECTED SHAFT OR COMPONENT AND REPAIR.



REPLACE SLAT ASYMMETRY COMPARATOR AND CYCLE CIRCUIT BREAKERS CB1-J10 AND CB2-H22 FOR 10 SECONDS.

OPERATE SLATS AND MONITOR SLAT OPERATION.

DO SLATS OPERATE CORRECTLY FOR FULL EXTENSION AND RETRACTION?

NOTE:

INTERMITTENT SLAT LOCKUP PROBLEMS CAN STILL BE CAUSED BY ASYMMETRY BRAKES AND/OR TRANSDUCERS DUE TO WATER INSIDE BRAKES OR MECHANICAL GEAR FAILURE.

THEREFORE, REPLACE BOTH ASYMMETRY BRAKES AND ASSOCIATED TRANSDUCERS FOR THESE TYPES OF PROBLEMS. (REF. MM 27-81-37)

VERIFY SLAT SURFACES ARE NOT MISMATCHED. REPLACE ASYMMETRY TRANSDUCERS AND RESET ASYMMETRY BRAKES AND CIRCUIT BREAKERS CB1-J10 AND CB2-H22. DOES PROBLEM REPEAT?

VERIFY SLAT SURFACES ARE NOT MISMATCHED. REPLACE ASYMMETRY BRAKES (INDIVIDUALLY). RESET CIRCUIT BREAKERS CB1-J10 AND CB2-H22 FOR 10 SECONDS. DOES PROBLEM REPEAT?

CHECK SLAT DRIVE SYSTEM FOR BROKEN OR DISCONNECTED JOINTS OR SHAFT. REPLACE OR REPAIR AS NECESSARY.

CHECK ASYMMETRY TRANSDUCER WIRING FOR OPEN CIRCUITS.

NOTE: DO NOT USE AC ELECTRIC PUMPS SINCE ERRATIC PRESSURE VARIATIONS CAN CAUSE ASYMMETRY BRAKE TO TRIP BECAUSE OF JERKY OPERATION.

NOTES:

SECTION 6.0

MECHANICAL ACTUATION SYSTEM PROBLEMS

This section should be used to isolate and correct faults that are caused by mechanical jams of the flap or slat surfaces. These problems can be caused by component mechanical failure, lack of lubrication, or friction. These types of problems can be difficult to locate due to the large area of these surfaces and quantity of mechanical parts. Therefore, this section is prepared based on previous problems for L-1011 aircraft and should be used to isolate problems as quickly as possible.

Select the historical problem that most closely resembles your problem, then follow the fault isolation procedures and recommendations on the proper page.

HISTORICAL PROBLEM		Troubleshooting Page
FLAPS – SECTION 6.1		
A.	Flaps fail to move when handle is commanded to retract or extend surface	55
B.	Flaps stop at 4° during retraction cycle	56
C.	Flaps jam at 8° to 10° position on retraction	56
D.	Flaps will not extend to commanded position. (The flaps creep down as airspeed decreases.)	62
SLATS – SECTION 6.2		
A.	Slats fail to move when flap handle is commanded to retract or extend surface	64
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6.1 FLAP FAULTS

A. Pilot Complaint

Flaps fail to move when flap handle is commanded to extend surfaces.

Probable Cause

1. Asymmetry brake experienced a mechanical overspeed trip, or asymmetry brake is faulty.
2. Flap startup switch (on the flap PDU) is stuck closed, maintaining PDU solenoid shutoff valves energized and hydraulic power shut down.
3. Water is frozen in asymmetry brake.

Fault Isolation

1. (a) Visually check each flap asymmetry brake for a mechanical trip.

   (b) Reset tripped asymmetry brake by applying 25 to 30 pounds of force on asymmetry brake trip knob.

   (c) Operate flaps and monitor system operation.

   (d) If problem persists, change associated asymmetry brake.

2. (a) Open CB2-H21 and CB-J11, which deenergize PDU solenoid shutoff valves and apply hydraulic power.

   (b) If flaps now operate normally, troubleshoot flap startup switch electrical circuits to determine if flap startup switch and/or PDU switchbox no. 1 has a failed-closed switch.

   (c) Replace faulty parts as required.

   (d) Close circuit breakers and check flap system for proper operation.

NOTE: Water frozen in asymmetry brake will cause flaps to jam in full-up position during winter operation.

B. Maintenance Checkout Complaint

Flaps fail to retract fully, stopping at approximately 4° on functional checkout of maintenance operation.

Probable Cause

Interference fit between flap vane and spoilers, caused by reinstalling flap vane carriage "frog assembly" upside-down.

Fault Isolation

1. Deploy spoilers.
2. If flaps then retract normally, visually inspect previously disassembled flap vane carriage assemblies for proper configuration and check for proper clearance between flap vane and spoiler.
3. Check flap lever pawl spring.

Fix

1. Correct frog assembly orientation.
2. Perform functional check.

C. Pilot Complaint

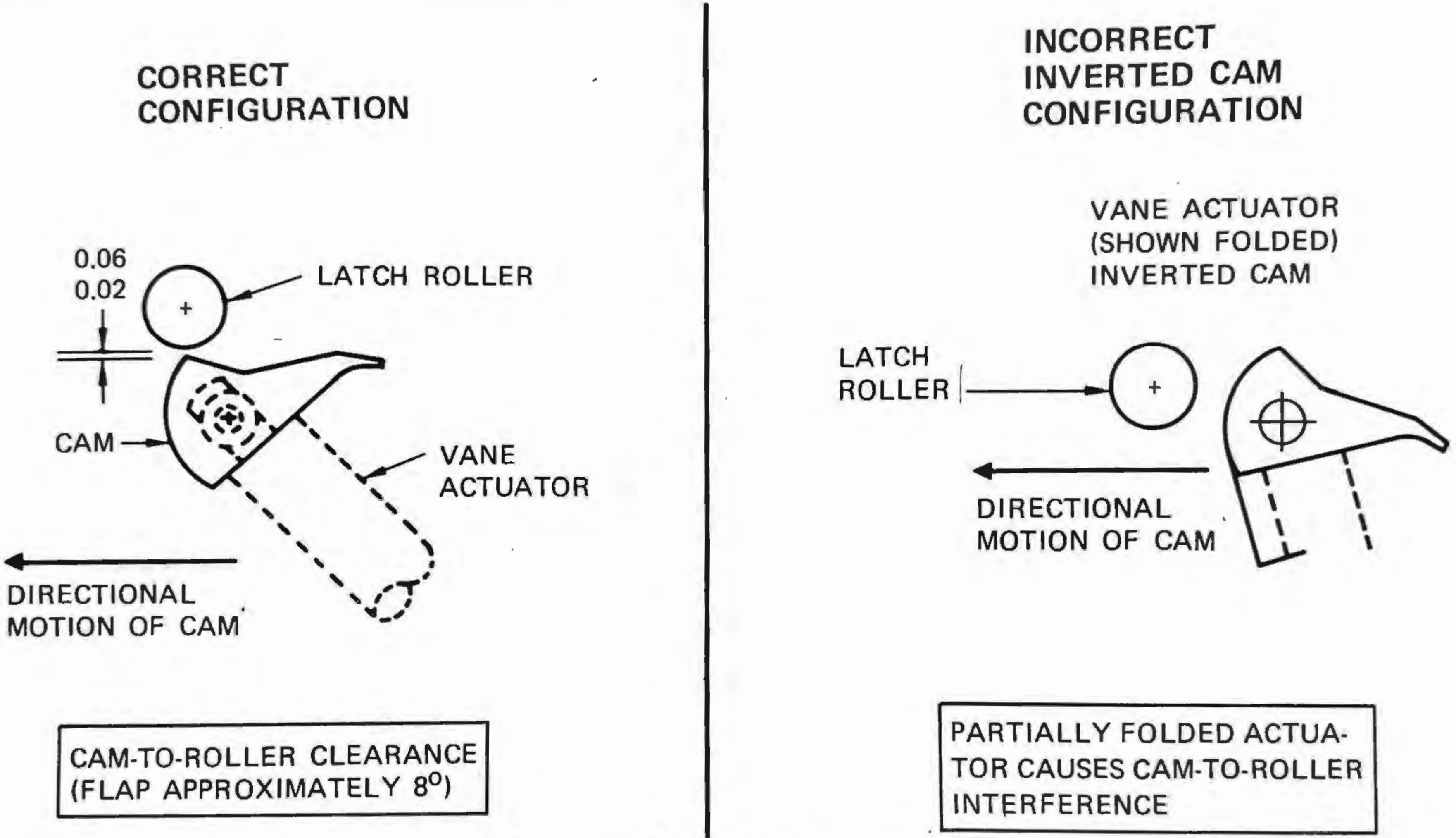
Flaps jam at 8° to 10° on retraction.

Probable Cause

1. If the vane actuator is partially folded, the inverted vane actuator cam is forced to ride under the latch roller when the flaps are retracted (see figure 17 for details).

   Partially folded vane actuator is possibly caused by:

   (a) Failure of vane actuator overcenter return spring and/or its operating cable.


CORRECT CONFIGURATION

INCORRECT INVERTED CAM CONFIGURATION

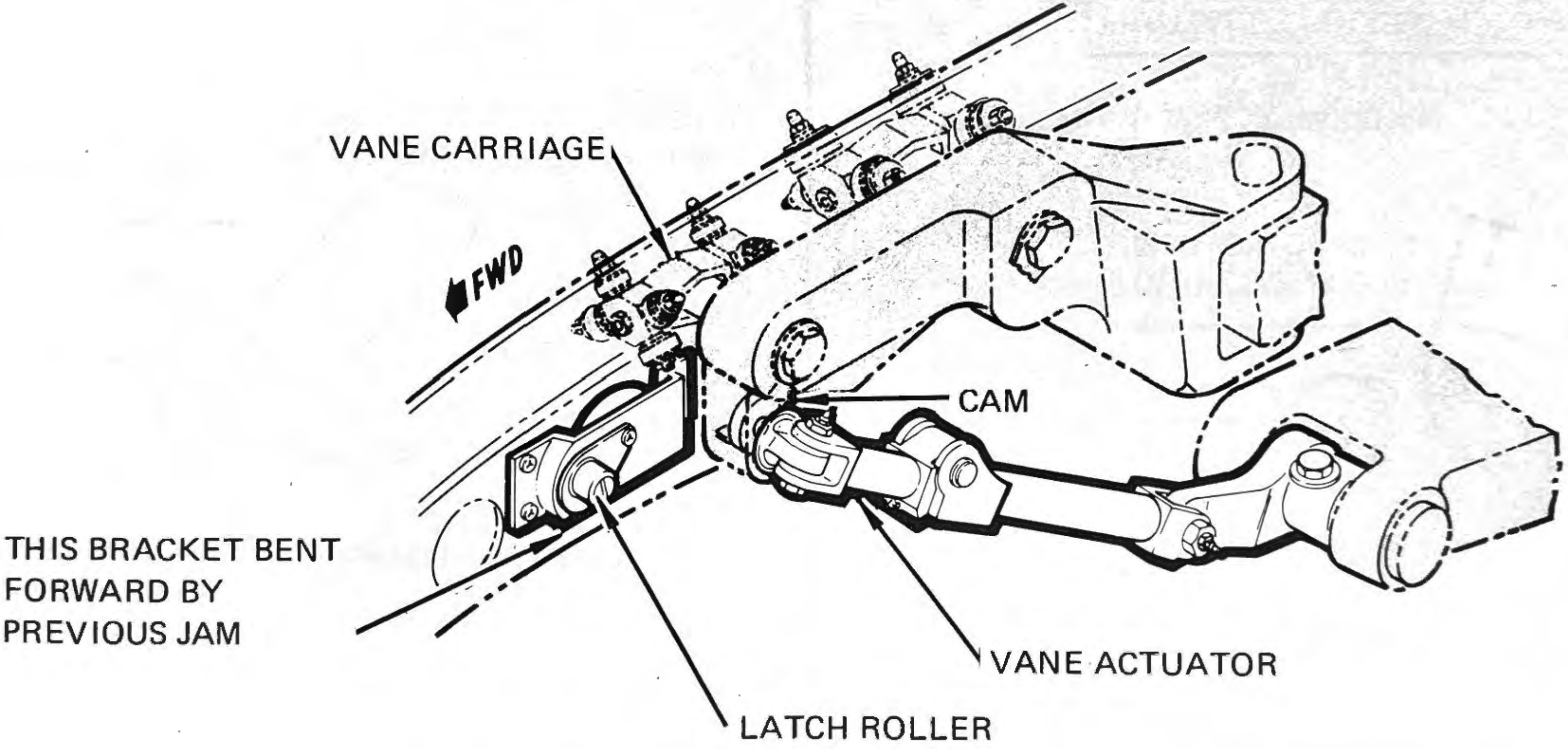
0.06
0.02
LATCH ROLLER
CAM
VANE ACTUATOR
DIRECTIONAL MOTION OF CAM
VANE ACTUATOR (SHOWN FOLDED) INVERTED CAM
LATCH ROLLER
DIRECTIONAL MOTION OF CAM

CAM-TO-ROLLER CLEARANCE (FLAP APPROXIMATELY 8°)

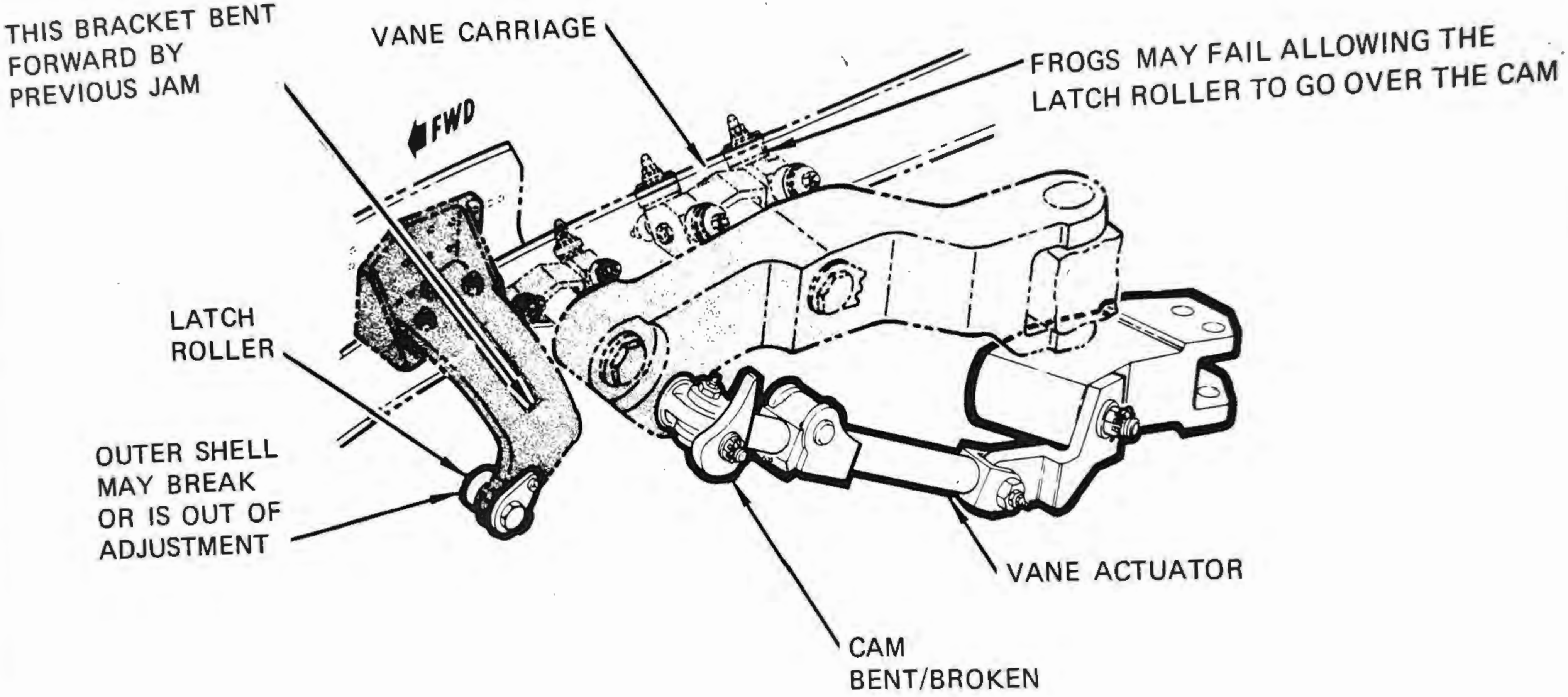
PARTIALLY FOLDED ACTUATOR CAUSES CAM-TO-ROLLER INTERFERENCE

(a) Correct and Incorrect Configurations.

Figure 17. Vane Actuator – Typical Problems.



(b) Inboard Vane Installation (Flaps No. 1 and 2).


THIS BRACKET BENT FORWARD BY PREVIOUS JAM
VANE CARRIAGE
FROGS MAY FAIL ALLOWING THE LATCH ROLLER TO GO OVER THE CAM
FWD
LATCH ROLLER
OUTER SHELL MAY BREAK OR IS OUT OF ADJUSTMENT
VANE ACTUATOR
CAM BENT/BROKEN

(c) Outboard Vane Installation (Flaps No. 3 and 4).

Figure 17. Vane Actuator – Typical Problems (Concluded).

(b) Lubrication mechanics' inadvertently leaving the actuator in the folded (unlocked) position.

When the problem occurs on first retraction,

(a) The latch roller bracket is usually bent up and in a forward direction.

(b) No. 1 and no. 2 vane latch rollers may fail and cams may be scored. The no. 3 and no. 4 vane latch rollers usually do not fail because the latch roller brackets have more elasticity.

If the flaps stall at approximately 8° on second retraction, the excessive side loads imposed may cause the vane carriage track rollers to fail.

NOTE: The vane actuator may sustain structural damage on subsequent flap retraction.

2. If a 0.53-inch bore diameter monoball-103 aft is installed on the forward pin (which has a 0.49-inch diameter), subsequent buffeting of the flap vane shears the forward pin, causing the vane actuator cam to miss its latch roller on retraction.

3. If the vane carriage pin nut becomes loose, the vane may shift laterally and droop, causing the vane actuator cam to miss its latch roller on retraction.

Fault Isolation

1. Deploy flaps and inspect for "popped" flap actuator gearbox overtorque indicators. A jam will normally pop the operating overtorque indicators.

NOTE: Start at the wingtip and work inboard, since most jams occur at the no. 3 and no. 4 vanes.

2. Visually inspect each assembly for

    (a) Bent or broken vane actuators or latch roller brackets.

    (b) Failed rollers.

    (c) Scoring on lower surface and heel of vane actuator cam (vanes no. 1 and no. 2 only).

3. Perform "shake test" by pushing and pulling on flap vane at each vane carriage assembly. Excessive play indicates failed monoballs(s) and/or loose or missing pin nuts. Remove the "frog assembly" for verification of structural failure.

4. Inspect the right-angle gearbox (in main wheel well) for paint discoloration, indicating overheating, case cracks, and oil leak caused by repeated braking actions.

Fix

1. Replace any vane actuator that has weak springs or damaged operating cables.

2. Replace damaged no. 1 and no. 2 latch roller brackets.

NOTE: Bent no. 3 and no. 4 latch roller brackets usually cannot be visually detected on the airplane. Replace them if lower surface of cam is scored.

3. Replace failed monoball(s) and/or pin nuts with preferred spare.

Monoballs

P/N 1608937-101, -103
Service Kit 57-119 (1624854)*

Castellated Nuts

P/N RME 9868-5
Service Kit 57-117 (1622640)

4. Replace right-angle gearboxes 179618-1 (672422-101) with preferred spares 179618-2 (672422-103) (ref. Curtiss-Wright SB 179618-27-1).

5. Check for proper alignment and clearances between latch roller and vane cam after repairs are complete (ref. Maintenance Manual 27-51-00, rigging) and adjustment has been made.

6. Reset popout indicators.

D. Pilot Complaint

Flaps will not extend to commanded position. The flaps creep down as the airspeed decreases. In extreme cases, full deployment is achieved after landing while taxiing to the gate.

Probable Cause

Experience shows that with damaged rear mounts, airloads generate enough friction to stall the flaps in flight. As airloads decrease (with reduction of airspeed during letdown), the flaps creep down to the commanded position. On the ground, with only running friction loads present, flap operation is normal. A siezed flap swing link pin will cause a similar problem.

Fault Isolation

1. Deploy flaps and check for one or more popped flap actuator gearbox overtorque indicators.

2. (a) X-ray near mounts to determine mechanical integrity.

   (b) If X-ray is not possible:

      (i) Disconnect the rear mount from the jackscrew (at each popped indicator) by removing the two bolts coupling the rear mount to the jackscrew.

(ii) Slide the stop sleeve forward to expose rear mount shaft.

(iii) Push/pull on shaft to simulate a thrust load while rotating the shaft by hand. Any roughness or binding is cause for replacement.

3. Check jackscrew lands and grooves for chips, scoring, or other physical deterioration.

4. Inspect for failed/damaged swing link flap carriage rollers, which would indicate seized swing link pins.

5. (a) Inspect the forward right-angle gearbox (in the left and right main landing gear wheel wells) for paint discoloration. Paint discoloration is caused by heat generated from repeated applications of the right-angle gearbox torque brake. The right-angle gearbox brake is applied only if excessive friction exists in the flap drive train outboard of the right-angle gearbox.

NOTE: Repeated cycling of the flaps and then feeling the right-angle gearboxes for overheat will indicate which wing has the high-friction problem.

(b) Inspect right-angle gearbox for case cracks. These cracks are usually indicated by case oil leaks.

(c) If excessive drag in the right-angle gearbox is suspected, disconnect input and output torque tubes and rotate input shaft by hand (using adapter from Curtiss-Wright kit P/N ST 6918 and a 0 to 50-inch-pound torque wrench) three revolutions in either direction. Steady-state frictional drag torque shall not exceed 40 inch-pounds.

NOTE: Internal friction in the right-angle gearbox is not sensed by its torque sensor.

Fix

1. None.
2. Replace defective rear mounts with preferred spare, incorporating service bulletin 27-180-R1.
3. Replace jackscrew components as required.
4. Replace seized swing link pins and associated rollers as required, incorporating service bulletin 27-137.
5. Replace right-angle gearbox. Paint discoloration, excessive internal friction, and case/seal oil leaks are cause for replacement.
6. Lubricate rear mount and/or swing link as required.
7. Recheck rigging of flap actuator stop clearance.
8. Reset overtorque (popout) indicators.

6.2 SLAT FAULTS

A. Pilot Complaint

Slats fail to move when flap handle is commanded to retract or extend surface.

Probable Cause

1. Asymmetry brake experienced a mechanical overspeed trip, or asymmetry brake is faulty.
2. Slat startup switches. Slats will extend by opening circuit breakers CB1-J10 and CB2-H22. Slats will retract normally when circuit breakers are closed.

Fault Isolation

1. (a) Visually check each slat asymmetry brake for a mechanical trip.

   (b) Reset tripped asymmetry brake by applying 25 to 30 pounds of torque on manual reset device by using 9/16-inch wrench as illustrated on figure 5.

   (c) *Operate slats and monitor system operation.

   (d) If problem persists, change associated asymmetry brake.

2. Use multimeter to isolate faulty switch and/or activation lever.

Fix

1. *Reset asymmetry brakes as required. If problem persists, change associated asymmetry brake.

2. Replace slat startup switch or activation lever and/or PDU switchbox no. 2.

3. Close circuit breakers and check system for proper operation.

NOTE: Water frozen in the asymmetry brake will jam flaps and slats in the full-up position.

B. Pilot Complaint

Slats jammed during deployment.

Probable Cause

1. Asymmetry brake experienced a mechanical overspeed trip.*

2. Slat drive component failed, jamming the system.

Fault Isolation

1. Visually check each asymmetry brake for mechanical trip.*

---

*Do not use AC electric pumps since erratic pressure variations can cause asymmetry brake to trip because of jerky operation.

2. (a) Retract slats to full up.

(b) Deploy slats and note which slat stops first. The serviceable slats will travel approximately an additional 1/2 inch before locking up the torque limiter.

NOTE: Slats 1, 2, and 3 mismatch by approximately 1/4 inch; slats 4, 5, 6, and 7 mismatch by approximately 1/2 inch.

3. If jam is still undetected:

(a) Disconnect the drive torque tubes at the slat PDU.

(b) Hand rotate the separated torque tubes to determine which wing has the jammed drive train.

NOTE: If both torque drives rotate freely, replace slat PDU.

(c) On the wing where the jam exists, progressively disconnect torque tubes, working outboard, until the jammed slat component is isolated.

Fix

1. Reset asymmetry brakes as required. If a problem persists, change associated brake, but DO NOT USE AC PUMPS.*

2. Replace jammed slat component as required.

C. Pilot Complaint

Slats jam on deployment in flight. Check OK on ground test.

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*Do not use AC electric pumps since erratic pressure variations can cause asymmetry brake to trip because of jerky operation.

Probable Cause

1. Improper adjustment of slat track airload rollers.
2. Seized and/or flat slat track airload rollers.
3. Excessive play between slat actuator ballscrew and its associated jackscrew.

Fault Isolation

1. Check slat track airload rollers for proper adjustment.

   NOTE: If the rollers are out of adjustment, the slats will lift when deployed in flight.

2. Check slat track rollers for free rotation and/or flat spots.
3. Check actuators:
   (a) Check each slat actuator for a tripped overtorque (mouse-trap) indicator.

   NOTE: Slat actuator overtorque (mouse-trap) indicators can be viewed through jackscrew opening with slats deployed.

   (b) Perform ballscrew inspection and test per MM 27-81-21, page 601, on each slat actuator found with a tripped mouse-trap indicator.

Fix

1. Re-rig slat track rollers as required.
2. Replace defective rollers as required.
3. Replace slat actuators that have excessive end play.

NOTES:

APPENDIX 1

ASYMMETRY DETECTION SYSTEM DIAGRAMS

Legend for Figures 18 and 19

Steady-state 28-VDC sources:

Ⓐ, Ⓑ, Ⓕ, Ⓖ, Ⓗ

Sources of 28 VDC when flaps are up:

Ⓒ, Ⓓ, Ⓨ, Ⓩ

Sources of 28 VDC when an asymmetry occurs:

Ⓒ, Ⓓ, Ⓨ, Ⓩ, Ⓜ, Ⓝ, Ⓔ, Ⓧ, Ⓡ, Ⓢ

Sources of 28 VDC when a control cable breaks or when a divergence comparator operates:

LL1, LL2, Ⓒ, Ⓓ, Ⓨ, Ⓩ

Steady-state 5-VDC sources:

5VA, 5VB, 5VC

Five-volt logic signals that go high for a monitor-detected failure:

A FAIL, B FAIL, C FAIL

Logic signals that go high momentarily to reset a counter in each channel when flaps start to extend:

CRA, CRB, CRC

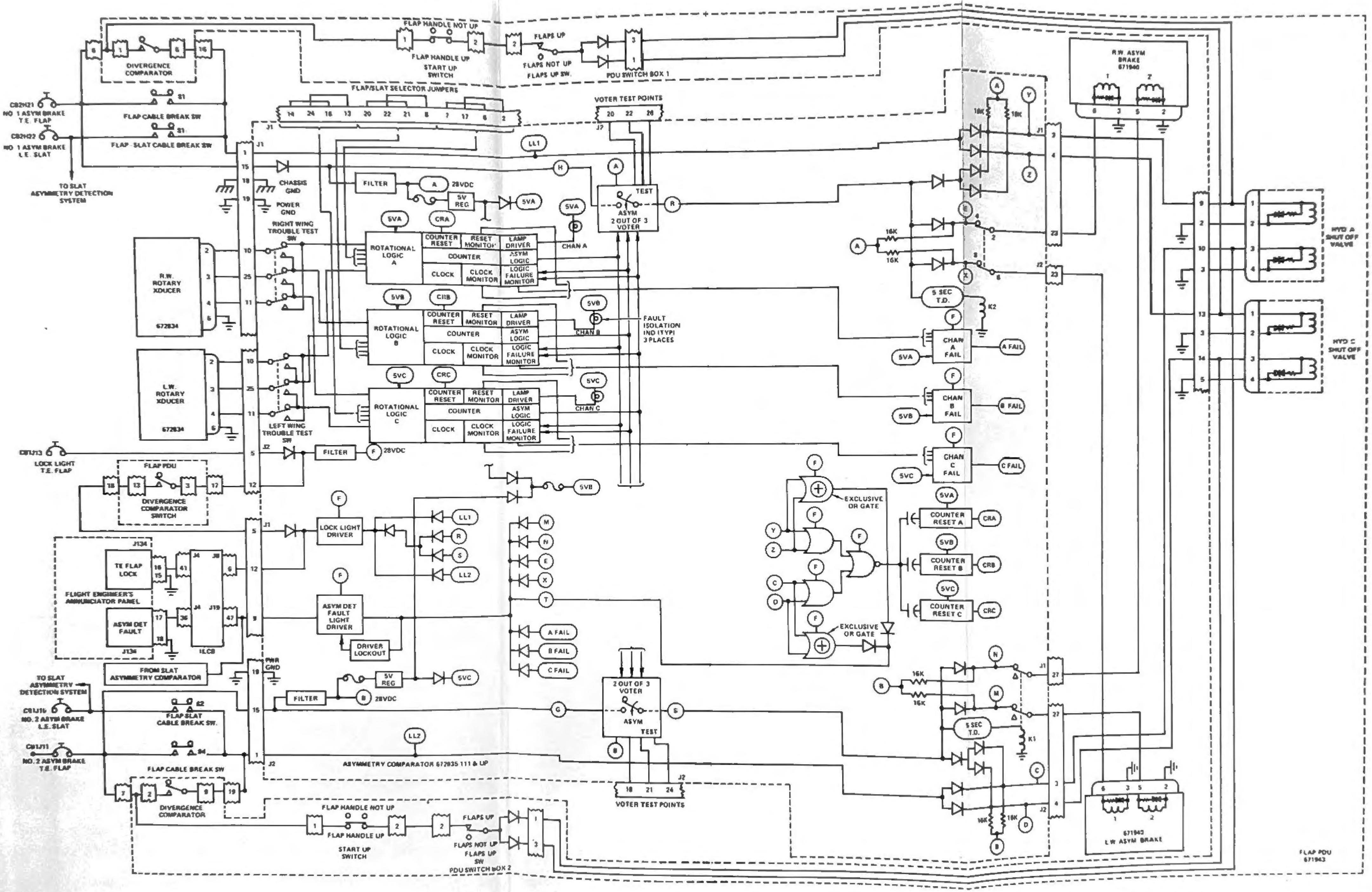

Figure 18. Flap Asymmetry Detection System and Electrical Control.

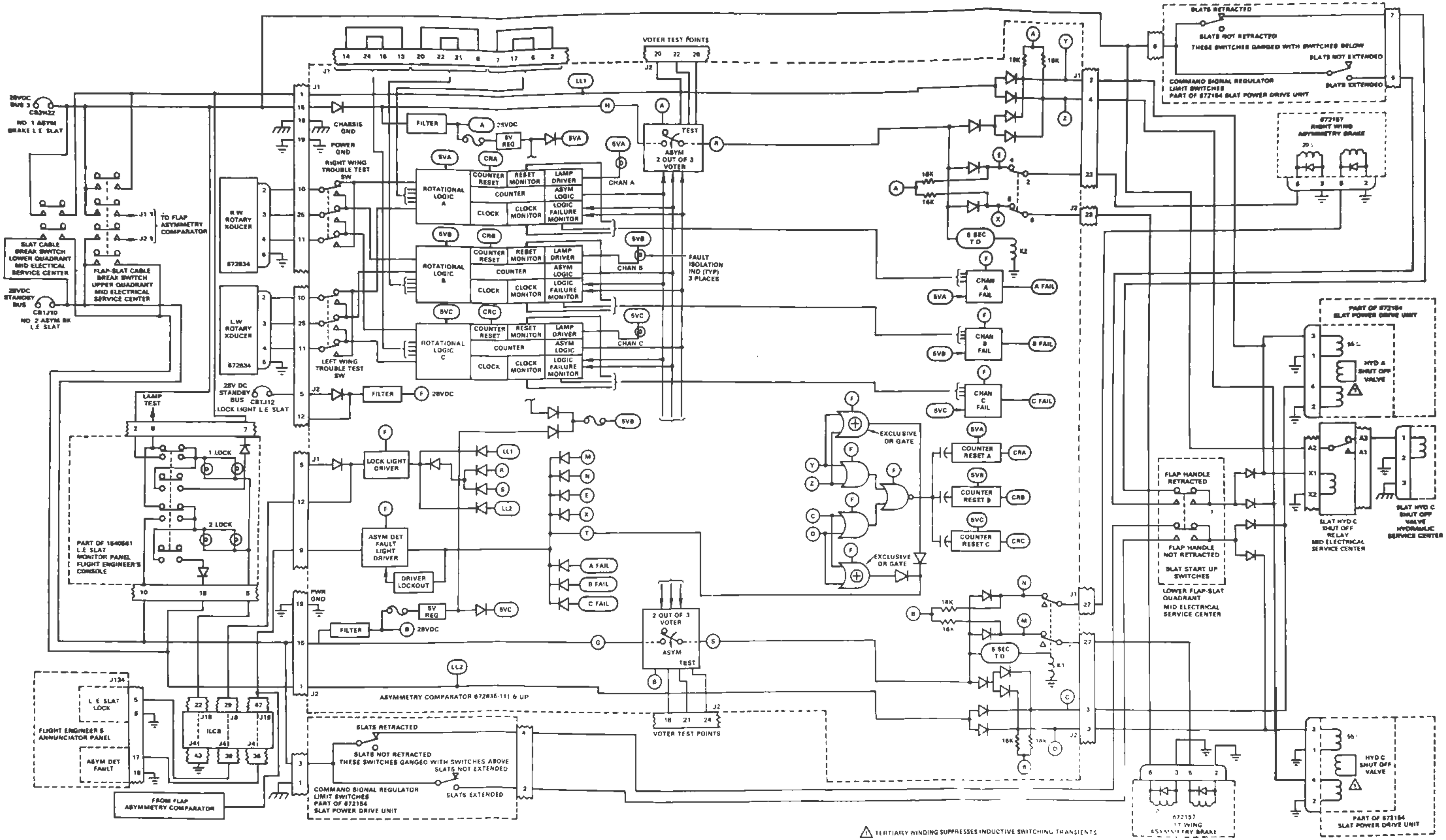
28VDC BUS 3
CB3H22
NO. 1 ASYM BRAKE L.E. SLAT
SLAT CABLE BREAK SWITCH LOWER QUADRANT MID ELECTRICAL SERVICE CENTER
FLAP-SLAT CABLE BREAK SWITCH UPPER QUADRANT MID ELECTRICAL SERVICE CENTER
TO FLAP ASYMMETRY COMPARATOR
28VDC STANDBY BUS
CB1J10
NO. 2 ASYM BK L.E. SLAT
R.W. ROTARY XDUCER
672834
L.W. ROTARY XDUCER
672834
28V DC STANDBY BUS
CB1J12
LOCK LIGHT L.E. SLAT
LAMP TEST
1 LOCK
2 LOCK
PART OF 1540561 L.E. SLAT MONITOR PANEL FLIGHT ENGINEER'S CONSOLE
J134
L.E. SLAT LOCK
FLIGHT ENGINEER'S ANNUNCIATOR PANEL
ASYM DET FAULT
ILCB
FROM FLAP ASYMMETRY COMPARATOR
CHASSIS GND
POWER GND
RIGHT WING TROUBLE TEST SW
LEFT WING TROUBLE TEST SW
FILTER
28VDC
5V REG
ROTATIONAL LOGIC A
ROTATIONAL LOGIC B
ROTATIONAL LOGIC C
COUNTER RESET
RESET MONITOR
LAMP DRIVER
COUNTER
ASYM LOGIC
CLOCK
CLOCK MONITOR
LOGIC FAILURE MONITOR
CHAN A
CHAN B
CHAN C
FAULT ISOLATION IND (TYP) 3 PLACES
VOTER TEST POINTS
TEST
ASYM
2 OUT OF 3 VOTER
LOCK LIGHT DRIVER
ASYM DET FAULT LIGHT DRIVER
DRIVER LOCKOUT
PWR GND
ASYMMETRY COMPARATOR 672836-111 & UP
SLATS RETRACTED
SLATS NOT RETRACTED
THESE SWITCHES GANGED WITH SWITCHES ABOVE
SLATS NOT EXTENDED
SLATS EXTENDED
COMMAND SIGNAL REGULATOR LIMIT SWITCHES PART OF 672154 SLAT POWER DRIVE UNIT
EXCLUSIVE OR GATE
CHAN A FAIL
CHAN B FAIL
CHAN C FAIL
A FAIL
B FAIL
C FAIL
COUNTER RESET A
COUNTER RESET B
COUNTER RESET C
5 SEC TD
K1
K2
18K
16K
THESE SWITCHES GANGED WITH SWITCHES BELOW
COMMAND SIGNAL REGULATOR LIMIT SWITCHES PART OF 672154 SLAT POWER DRIVE UNIT
672157 RIGHT WING ASYMMETRY BRAKE
PART OF 672154 SLAT POWER DRIVE UNIT
HYD A SHUT OFF VALVE
FLAP HANDLE RETRACTED
FLAP HANDLE NOT RETRACTED
SLAT START UP SWITCHES
LOWER FLAP-SLAT QUADRANT
MID ELECTRICAL SERVICE CENTER
SLAT HYD C SHUT OFF RELAY
MID ELECTRICAL SERVICE CENTER
SLAT HYD C SHUT OFF VALVE
HYDRAULIC SERVICE CENTER
HYD C SHUT OFF VALVE
PART OF 672154 SLAT POWER DRIVE UNIT
672157 LT WING ASYMMETRY BRAKE
1 TERTIARY WINDING SUPPRESSES INDUCTIVE SWITCHING TRANSIENTS

Figure 19. Slat Asymmetry Detection System and Electrical Control.

APPENDIX 2

ASYMMETRY TRIP LOGIC

"A" Brake Trip		FLAT/SLAT LOCK Light		Position of PDU Hyd SOV		ASYM DET FAULT Fail Light		COMPARATOR FAULT ISOLATION CHAN IND		Fault Conditions
Yes	No	On	Off	Close	Open	On	Off	On	Off	
X			X		X		X		X	"A" brake mechanical trip/ lock—Overspeed
X		X		X			X	X		"A" brake electrical trip/lock
	X	X		X			X		X	PDU divergence trip
	X	X		X			X		X	Flap cable break switch closed
	X	X		X			X		X	Flap/slat cable break switch closed
X		X		X			X	X		Two or more channels of wing transducer erratic or wire open or shorted to ground

"A" Brake Trip		FLAT/SLAT LOCK Light		Position of PDU Hyd SOV		ASYM DET FAULT Fail Light		COMPARATOR FAULT ISOLATION CHAN IND		Fault Conditions
Yes	No	On	Off	Close	Open	On	Off	On	Off	
	X		X		X	X		X		One channel of wing transducer erratic or wire open or shorted to ground
	X		X		X	X			X	Coil in "A" brake solenoid open (any)
	X		X		X	X			X	Coil in PDU SOV solenoid open (any)
	X		X		X	X			X	5 VDC, A, B, C
	X		X		X	X			X	Counter reset, A, B, C
	X		X		X	X			X	Clock, A, B, C
	X		X		X	X		*	*	Channel A logic fail
	X		X		X	X		*	*	Channel B logic fail
	X		X		X	X		*	*	Channel C logic fail

*COMPARATOR FAULT ISOLATION CHAN IND light may be on or off